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PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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SHEFFIELD.

Tramway
Points and Crossings,
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Hadfield's Patent
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is the supreme material for
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These two pairs of Hadfield's Tramway Wheels and Axles have been in use on the Sheffield Corporation Tramways for a period of 2½ years on routes of difficult and steep gradients, and during that time have travelled a distance of 79,680 miles. The wheels have worn equal in diameter, and have never been returned or removed from service during this time.

Wheels and Axle before being put to work, shown for comparison.

MALLEABLE IRON
CASTINGS.

The Hardy Patent Pick Company,
LIMITED.
SHEFFIELD, ENGLAND.

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars.

PAGE & ROWLINGSON,
Chartered Patent Agents.
Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*
28, NEW BRIDGE STREET, LONDON, E.C.,
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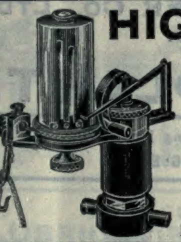

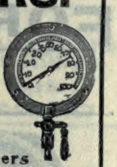

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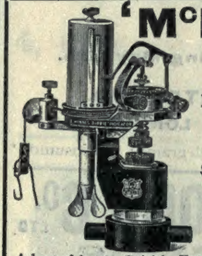

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Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
Adopted by the British, French, and Japanese Admiralties.
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Of all Descriptions and for all Purposes.
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Alternating to Continuous Motor Generators.
DYNAMOS
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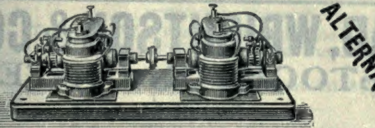
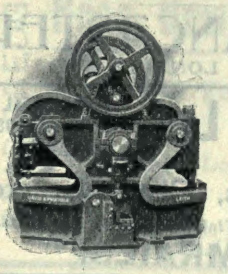


THE CRYPTO ELECTRICAL CO.,
Telephone : 12830 CENTRAL.
3, Tyers Gateway,
BERMONDSEY ST., S.E.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

THE ACME WATER STORAGE and CONSTRUCTION CO., Ltd.,
Patented March 9th, 1897. U.S.A.
Water stored where most convenient under pressure and automatically distributed.
For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.
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ERIC S. A. SMITH, Water Supply Engineer, BRIDLINGTON.
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PATENT WATER-TUBE BOILERS.
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing May 12th, page 37.
HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
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Horsfall Destructor Co., Ltd., Armley, Leeds.
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Price List on application to—
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PAGE'S WEEKLY Miscellaneous

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Samples, Lists, and Testimonials on application.

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Tested to 350 lb. Steam Pressure.

For High Pressure Boilers.

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See our Advertisement appearing May 12th.

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Telephone: 365 London Wall. Telegrams: "Transumo."

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FORGING PLANT.

See our Advertisement appearing May 12th.

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ALL ACCESSORIES AND OTHER MATERIALS.

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For further particulars . . of our . . see our whole page Ad. on 12th May.

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PAGE'S WEEKLY Miscellaneous

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Blue Planished and Glazed Steel Sheets for Lagging

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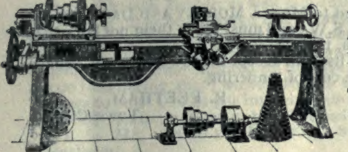

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(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

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Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

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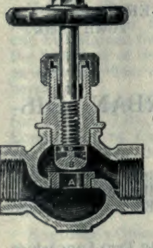

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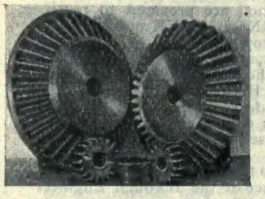

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GRAB DREDGERS.

OIL REFINERIES.

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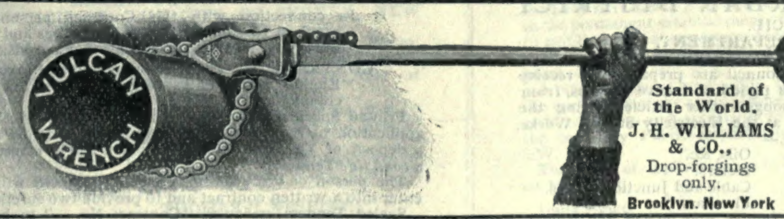

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Brooklyn, New York

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Manufacturers of

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Forward Works, Barn Street, BIRMINGHAM.

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ENORMOUS Saves 12 to 80 Men's Work. **PROFITS**

M. GLOVER & CO., Saw Mill Engineers, LEEDS.

PAGE'S WEEKLY Contracts

CONTRACTS.

COUNTY OF SALOP. — TO STEEL BRIDGE BUILDERS.

TENDERS are invited for the TAKING DOWN of the old CAST-IRON BRIDGE at Buildwas, and for the SUPPLY and ERECTION in its place of a STEEL CURVED GIRDER BRIDGE.

Copies of the drawings and specification may be obtained at my office on and after Wednesday, April 19th, on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, on the form supplied, endorsed "Steel Bridge," must be delivered at my office not later than 10 a.m. on Wednesday, May 3rd.

Power is reserved to reject the lowest or any Tender.

(Signed) A. T. DAVIS, M.Inst.C.E.,
County Surveyor.

Shirehall, Shrewsbury,
April 12th, 1905.

COUNTY BOROUGH OF CROYDON.

STROUD GREEN WELL.

Notice is hereby given that the Council are prepared to receive TENDERS for a DEEP WELL PUMPING ENGINE and BOILERS for the Stroud Green Well, Woodside, Croydon.

Particulars and conditions may be seen, and a copy obtained on payment of a deposit of One Guinea, at the office of GEO. F. CARTER, A.M.Inst.C E., Borough Engineer, Town Hall, Croydon. The deposit will be returned upon receipt of a *bonâ fide* Tender.

Tenders to be sent to me by Eleven o'clock in the forenoon on Wednesday, the 26th April, 1905, endorsed "Pumping Plant, Stroud Green Well."

Tenders will only be received subject to the terms of the draft contract which has been deposited at the office of the Borough Engineer as aforesaid, and may be inspected during office hours.

The Council will not be bound to accept the lowest or any Tender.

Town Hall, Croydon,
March 31st, 1905.

F. C. LLOYD,
Town Clerk.

COUNTY BOROUGH OF STOCKPORT

TO ELECTRICIANS AND ENGINEERS.

The Gas and Electricity Committee are prepared to receive TENDERS for the SUPPLY of ONE 500 KW. STEAM GENERATOR.

Specification and particulars may be had on application to Mr. A. J. H. CARTER, Electricity Works, Millgate, Stockport, on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Persons tendering must submit drawings and full particulars to Mr. A. J. H. CARTER, Electricity Works, Millgate, Stockport, on or before April 17th, and Tenders, endorsed, "Dynamo." and addressed to the Chairman, Gas and Electricity Committee, must be handed in at the Town Clerk's office, Stockport, not later than Wednesday, the 26th April next ensuing.

No Tender will be accepted without satisfactory proof that the firm tendering pays the trade union rate of wages and observes the trade union number of hours as are usually paid and observed in the district where the goods are made or produced.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HYDE,
Town Clerk.

Stockport, March 31st, 1905.

WALLASEY URBAN DISTRICT COUNCIL.

ELECTRICITY DEPARTMENT.
CONTRACT FOR STORES.

The Wallasey Urban District Council are prepared to receive TENDERS for the SUPPLY over a period of twelve months, from June 30th next, the following, amongst other articles, being the principal STORES required for use at the Electricity Supply Works, Seaview Road, Liscard, Cheshire, viz.—

Cotton Waste.
Coal Shovels.
Bolts and Nuts.
Switches and Cut-outs.
Oils, &c.
Meters.
Cable and Junction Boxes.
Fire-bars, &c.

Further particulars, with form of Tender, may be had, and samples inspected, on application to the Engineer, Mr. J. A. CROWTHER, at his office at the said works.

Sealed Tenders, which must be on the printed form, endorsed "Tender for Electricity Stores," and addressed to the undersigned, to be delivered per post at my office, as below, not later than the morning of the 27th April, 1905.

The contractors will be required to enter into a formal contract.

The Council reserve the right to accept the whole or part of a Tender, and do not bind themselves to accept the lowest or any Tender.

By order,
H. W. COOK,
Clerk and Solicitor.

Public Offices, Egremont, Cheshire,
April 6th, 1905.

TENDERS will be received by the Montreal Water and Power Company up to May 15th next on a Fifteen Million Gallon High-duty STEAM PUMPING PLANT, BOILERS, etc., 175lb. water pressure. Specifications can be had on application to the Offices of the above Company, 62, Alliance Building, 107, St. James Street, Montreal, Canada.

MUNICIPALITY OF JOHANNESBURG.

SPECIFICATION No. 15.—SWITCHBOARDS.

The Council is prepared to receive TENDERS for the Supply and Erection of SWITCHBOARDS and ACCESSORIES for their New Direct and Alternating-current Power Station.

General Conditions, Specification, and Forms of Tender may be seen on and after Friday, March 31st, at the offices of the Council's Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and may be obtained from them on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender. Further copies of the General Conditions, Specification, and Forms of Tender may be obtained on payment of 10s., which will not be returned.

Tenders are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must reach them not later than noon on Thursday, April 27th, 1905.

The Council does not bind itself to accept the lowest or any Tender and is not responsible for the cost of tendering.

R. FEETHAM,
Town Clerk.

Johannesburg,
March 27th, 1905.

EDINBURGH CORPORATION ELECTRICITY SUPPLY.

The Lord Provost, Magistrates, and Council invite TENDERS for the following WORK, in connection with their Electricity Supply Station at M'Donald Road:—

Specification No. 16.—WATER-TUBE BOILERS.

Copies of the specification, form of Tender, general conditions, and drawings can be obtained from the Engineer, Dewar Place, Edinburgh, after Wednesday, April 19th, upon payment of a deposit of £2 2s., which will be refunded on receipt of a *bonâ fide* Tender, and on the return of the specification, general conditions, and drawings.

The specification, general conditions, and drawings can be seen at, but not obtained from, the office of Dr. A. B. W. KENNEDY, 17, Victoria Street, London, S.W.

Tenders, on the prescribed Form, enclosed in sealed envelope, and endorsed on the outside "Electricity Supply.—Tender for Specification No. 16," must be delivered at the office of the undersigned not later than Monday, May 8th, 1905.

THOMAS HUNTER, Esq.,
Town Clerk.

City Chambers, Edinburgh,
April 7th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the COUNCIL invite TENDERS for the CARRYING OUT of the FOLLOWING WORKS at their Sewage Pumping Station—viz.:—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender

By order,
THOS. SWATHERIDGE,
Clerk of the Council.

Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

NOTICE TO MANUFACTURERS OF COPPER PLATES.

THE DIRECTOR - GENERAL, ORDNANCE SURVEY, is prepared to receive APPLICATIONS from any FIRM which is willing to TENDER for the SUPPLY of COPPER PLATES for Photo Etching.

Applications for forms of Tender and specification should be made to the Officer in Charge of Stores, Ordnance Survey Office, Southampton.

All Tenders must be submitted before noon on the 3rd May, 1905.

PAGE'S WEEKLY Contracts

MANCHESTER CORPORATION GAS-WORKS.

TO OIL IMPORTERS AND OTHERS.

The GAS COMMITTEE of the Corporation of Manchester are prepared to receive TENDERS for the SUPPLY of OIL for the manufacture of Carburetted Water Gas. The oil to have a flashing point of not less than 73 degrees (Abel's test), and not less than any higher degree of temperature which may be specified in any future Act of Parliament or regulations to be made thereunder.

Full description, with the analysis of the oil offered, must be submitted with each Tender, as well as a sealed sample of the same. The quantity of oil to be delivered free of all charges (including Ship Canal dues) into the storage tanks of the Corporation at Trafford Wharf, on the banks of the Manchester Ship Canal, in such quantities as may be from time to time required by the Gas Committee, will be 10,000 to 15,000 tons ending the Twelve Months ending September 30th, 1906. Tenders to be at a price per imperial gallon.

Further particulars may be obtained on application (in writing only), to Mr. CHARLES NICKSON, Superintendent of the Gas Department.

Sealed Tenders and samples, addresssed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be delivered at the Office of the Superintendent of the Gas Department, Town Hall, Manchester, on or before Wednesday, May 10th, 1905.

The Corporation do not bind themselves to accept the lowest or any tender.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
April 7th, 1905.

BRISTOL DOCKS.—THREE ELECTRIC LIFTS.

The Docks Committee of the City and County of Bristol are prepared to receive TENDERS for the CONSTRUCTION, DELIVERY, ERECTING in place, FITTING, TESTING, and MAINTENANCE for twelve months after completion, of TWO ELECTRIC GOODS LIFTS and ONE ELECTRIC PASSENGER LIFT, to be erected in the Tobacco Warehouse now in course of construction near Cumberland Basin, Bristol.

On and after Tuesday, April 11th, 1905, copies of the specification, form of Tender, form of Contract, and Copies of Contract Drawing can be obtained from the undersigned on production of a receipt from the Secretary of the Docks Committee showing that £3 has been paid as deposit. The deposit of £3 will be returned to *bona fide* tenderers hereafter.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Electric Lifts," and addressed to the Secretary of the Docks Committee, 19, Queen Square, Bristol, and must be delivered to him, accompanied by the prescribed documents, before 10 a.m. on Monday, May 1st, 1905.

The Docks Committee of the Council of the City and County of Bristol do not bind themselves to accept the lowest or any Tender.

W. W. SQUIRE,
Engineer.

Engineer's Office, Cumberland Basin, Bristol.
April 5th, 1905.

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite TENDERS for the SUPPLY and ERECTION of SIX-CELL REFUSE DESTRUCTOR and for a FLAG-MAKING PLANT at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.

Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

THE DUBLIN PORT AND DOCKS

Board is prepared to receive TENDERS for an ELECTRIC GENERATING STATION.

The specification and drawings, together with a special form of Tender, can be obtained at the office of the Engineer of the Board, JOHN P. GRIFFITH, Esq., M.Inst.C.E., East Wall, Dublin, on payment of Five Pounds, which will be refunded to firms sending in *bona fide* Tenders.

Tenders, with contractor's supplemental specification and drawings, marked on the outside of the cover "Tender for Electric Generating Station," must be delivered by post, sealed prepaid, and addressed to the Secretary, Port and Docks Office, Westmoreland Street, Dublin, on or before Monday, the 15th day of May, 1905.

The Board does not bind itself to accept the lowest or any tender.

By order,
N. PROUD,
Secretary.

Dublin Port and Docks Office,
April 3rd, 1905.

EAST INDIAN RAILWAY. — The East

Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of:—

(1) STEEL MATERIAL (Joists, Channels, Bulb-tees, etc.).
(2) MISCELLANEOUS TOOLS,

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Steel Material," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 3rd day of May proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of One Guinea is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
April 13th, 1905.

COLCHESTER CORPORATION WATER-WORKS.

TO PUMPING ENGINE and BOILER MAKERS, CONTRACTORS, AND OTHERS.

Notice is Hereby Given that the Corporation of Colchester are prepared to receive TENDERS for the SUPPLY, DELIVERY, ERECTION, FIXING, LAYING, JOINTING, SETTING TO WORK, and MAINTAINING for a given period, a TRIPLE-EXPANSION HORIZONTAL PUMPING ENGINE of the Worthington type, a MULTITUBULAR STEEL BOILER, TRAVELLER, CAST IRON PUMPING AND SUCTION MAINS, with CONNECTIONS to Existing Mains.

Plans and specification may be seen between 10 a.m. and 5 p.m. on and after 3rd inst., at the office of the undersigned, and a copy of the specification, with form of Tender attached, may be obtained on deposit of One Guinea, which will be returned to each depositor on his making a *bonâ fide* Tender, and returning the documents entrusted to him after a contract has been entered into.

Persons or firms tendering must tender for the whole scheme, and it is indispensable that they shall have had extensive experience in similar work, and be prepared to furnish good and approved security for the due fulfilment of the contract.

Tenders must be delivered at the Town Clerk's Office, Town Hall, by not later than 28th instant, in sealed covers, addressed to the Corporation of Colchester, and endorsed "Tender for Engine, Boiler, etc."

The Corporation do not bind themselves to accept the lowest or any Tender, nor will they pay any expenses in connection with any Tender.

By order,
C. E. BLAND,
Waterworks Superintendent.

Town Hall, Colchester,
April 3rd, 1905.

APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR

India in Council will, in the Summer of 1905, make not less than TWENTY-FIVE APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday, 1st May next.

A. GODLEY,
Under Secretary of State.

India Office,
March 23rd, 1905.

BOROUGH OF SWINDON.
EDUCATION COMMITTEE.

SWINDON AND NORTH WILTS SECONDARY SCHOOL AND TECHNICAL INSTITUTION.

President: Mr. G. H. BURKHARDT, M.Sc.

The Committee require, early in September next, an

ASSISTANT LECTURER IN ENGINEERING,

who will be required to take Classes in Electrical Engineering. Salary, £150 a year.

Form of Application, which must be returned by April 29th, may be had from

W. SEATON,
Secretary.

Education Office, Town Hall, Swindon,
April 3rd, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T, D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co.. Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97. Queen Victoria Street, London. E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa,, U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd.. Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd.. Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34. Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd,, Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

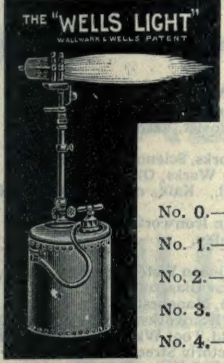
Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wells' Specialities



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UP TO 4,000 CANDLE POWER.

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Horizontal Flame Unaffected by Weather.

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ...	£10 0 0
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These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

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This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.

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WELLS' "NOGAS" PATENT OIL GAS LAMP

WELLS' OIL GAS GENERATING LAMP No. 40.

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Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...		16/- each.
" Double "	...	19/- "
Tripod Stands ...	...	3/- "
Extra Burners ...	...	2/- "

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LONDON, N.W.

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No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 "	£30 0 0
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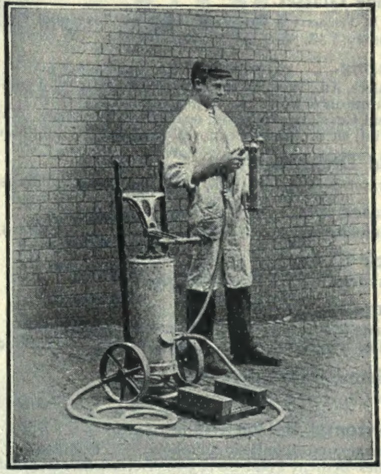

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or any class of painting where the work is not very heavy or continuous.

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Price £100.

No. 2 Painter, extr £30.

OVER 500 PLANTS SOLD.

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Firewood Machinery.

M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.

Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.

Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).

J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.

Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.

Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.

J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gearing.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.

Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.

Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).

Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.

See Conveying Machinery.

Horizontal Boring Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.

H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.

Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.

Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill. Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).

F. A. Keep, Juxon & Co.. Barn Street, Birmingham.

Lagging Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.

Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.

Williams, J. H , & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.

W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.

Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.

Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.

Asquith, William, Ltd., Highroad Well Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.

Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.

Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).

W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.

Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co.. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.

Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.

Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).

Metallic Paint Co., Ltd., Cardiff.

Paper.

Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.

Page & Rowlingson, 28, New Bridge Street, London, E.C.

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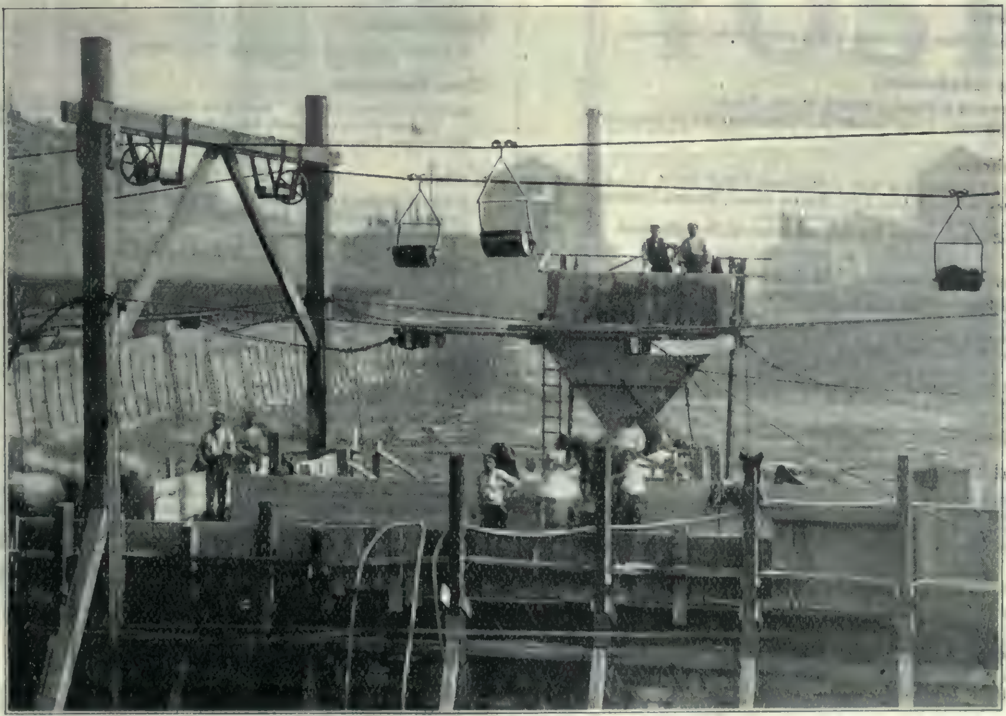

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Buyers' Directory—(*Continued*).

Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.
Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.
Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 10, St. George's Crescent, Liverpool, and 100c Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.
Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.
Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.
W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.
A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

Wire Working Machinery.
Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."
"Woodite" Company, Mitcham, Surrey.

Boltons' Downtake Superheater WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED.)

Simple and Reliable. Readily Applied. Inexpensive.

Saves 10 to 15 %

Is made of Steel throughout.

A large number working in—
Textile Mills,
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Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

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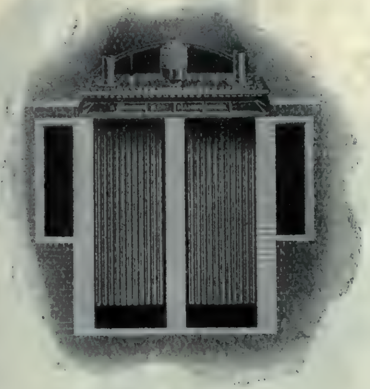

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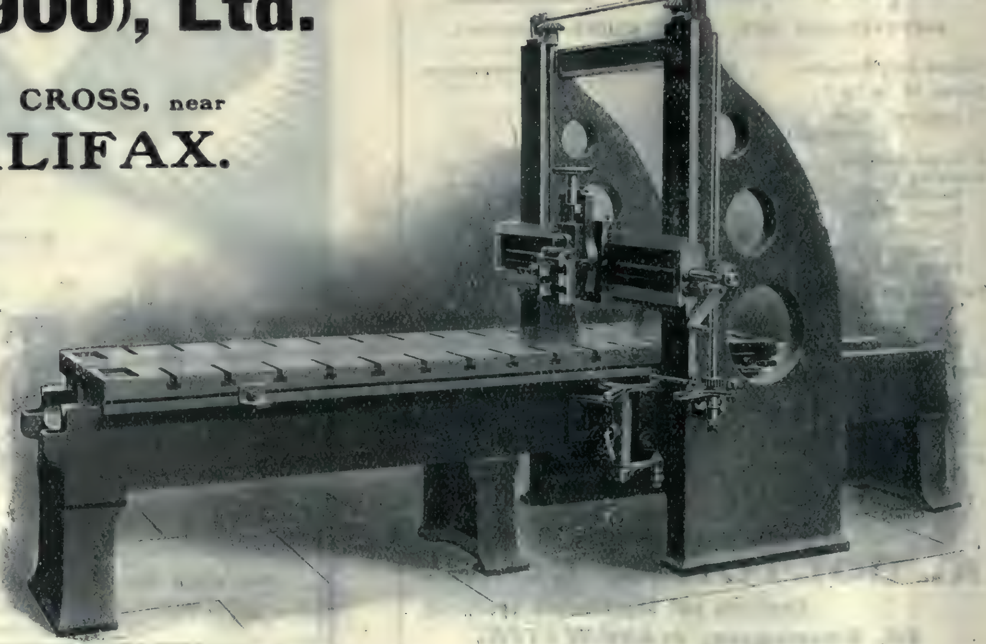

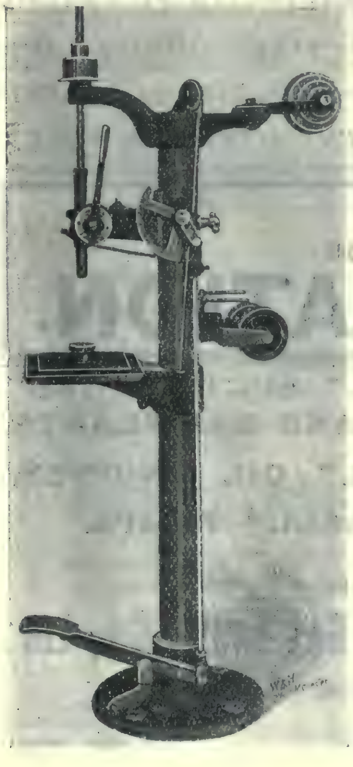

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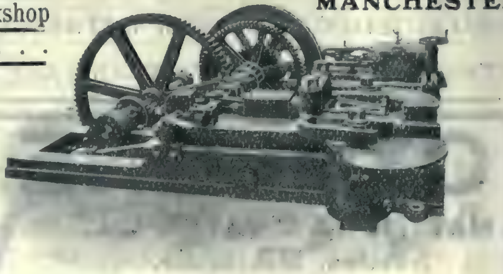

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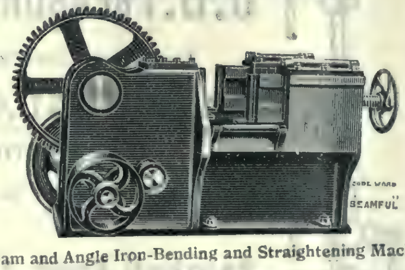

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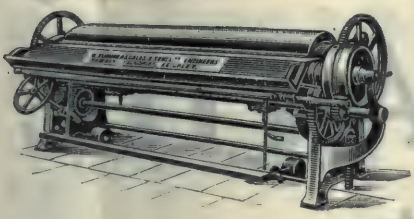

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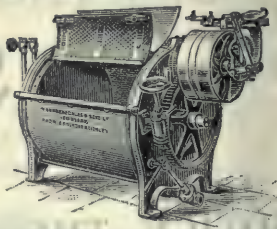

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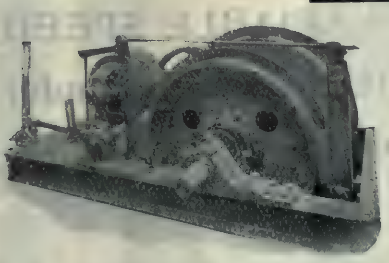

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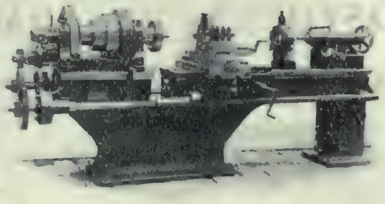

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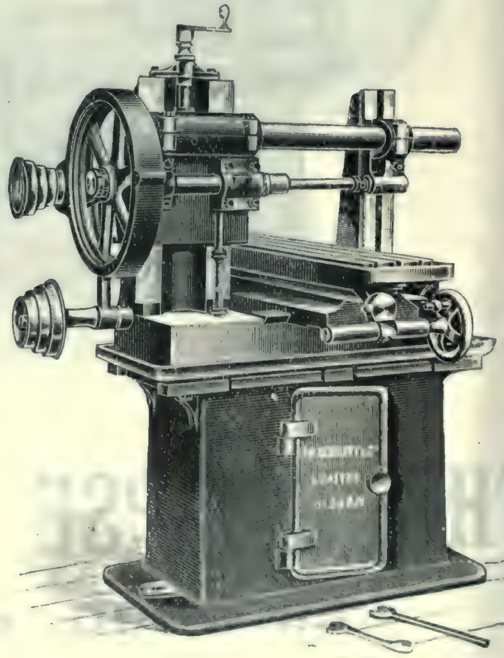

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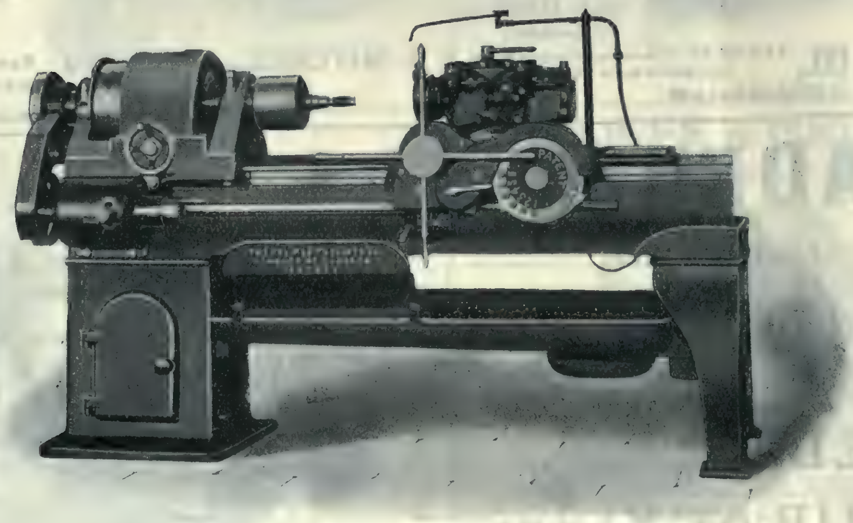

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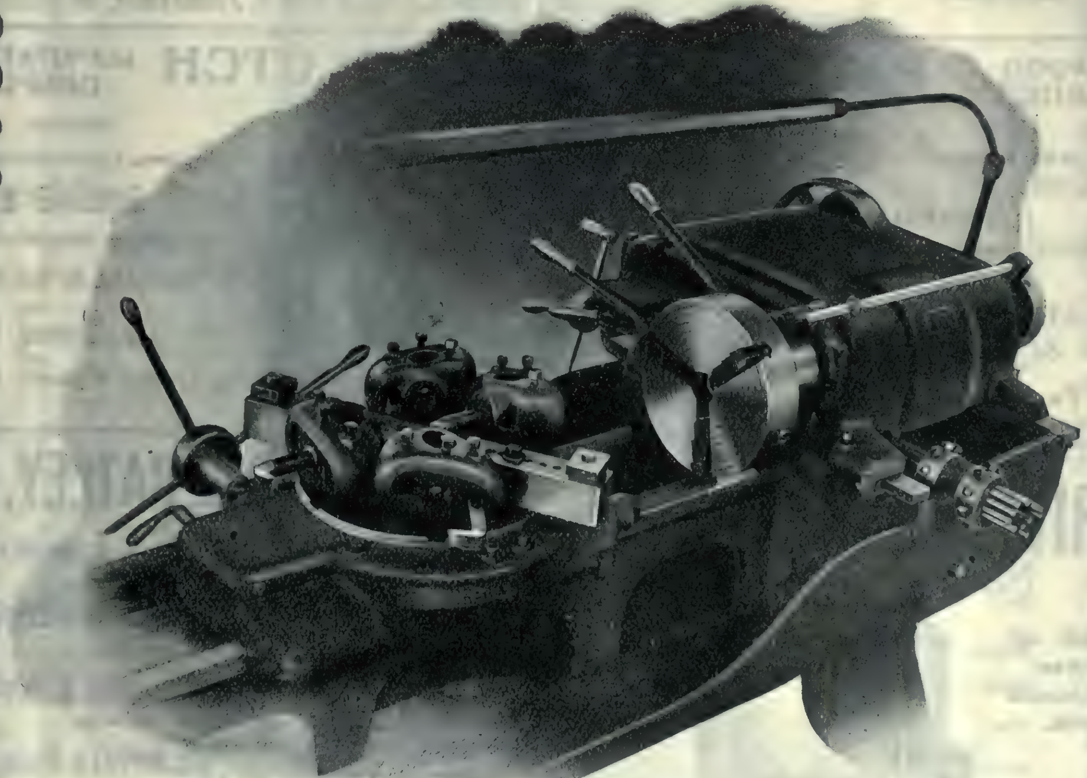

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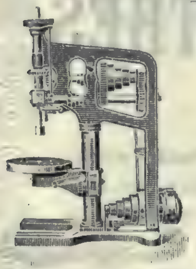

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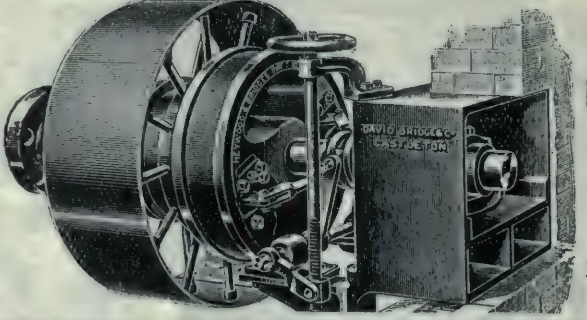

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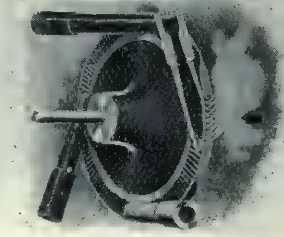

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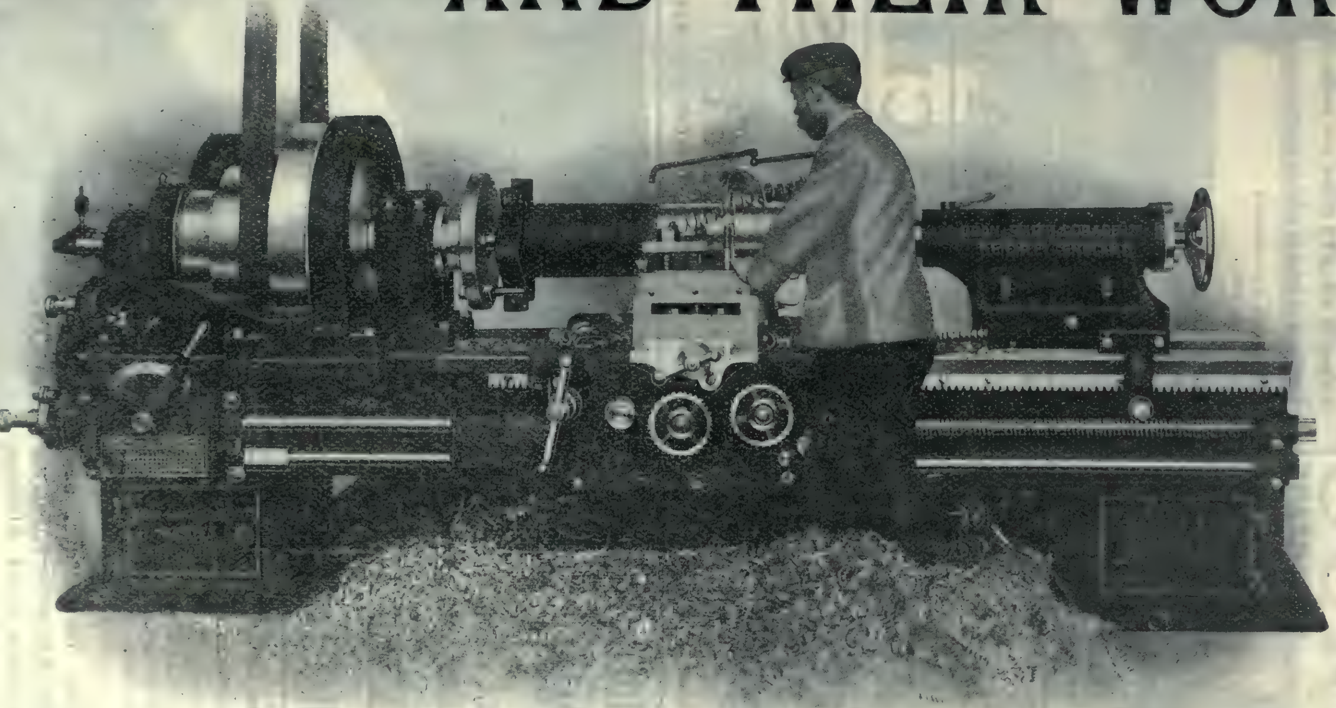

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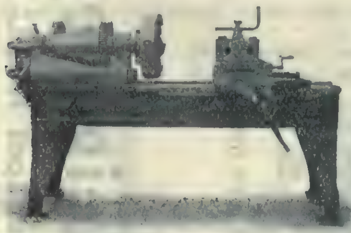

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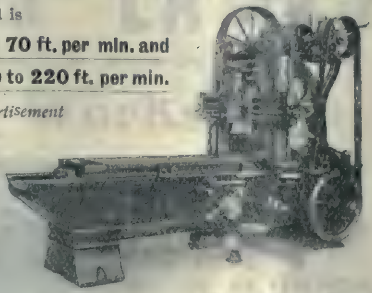

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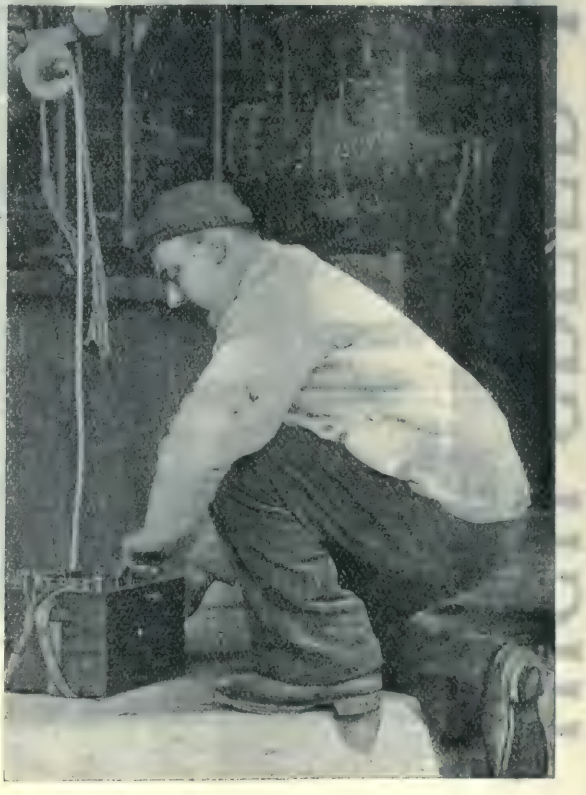

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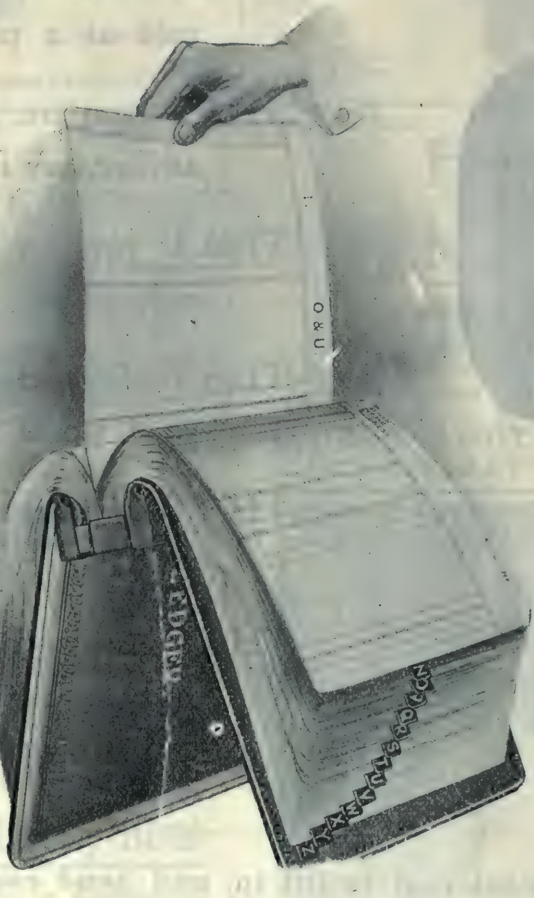

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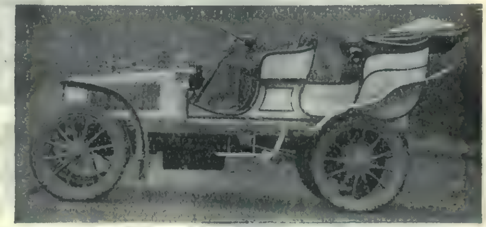

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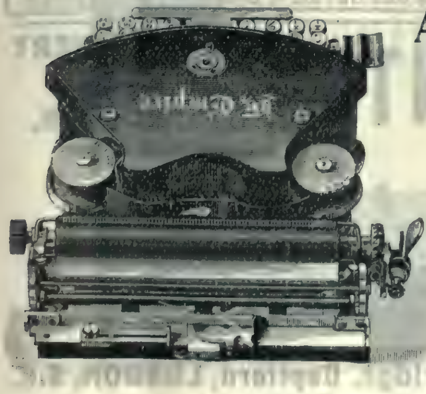

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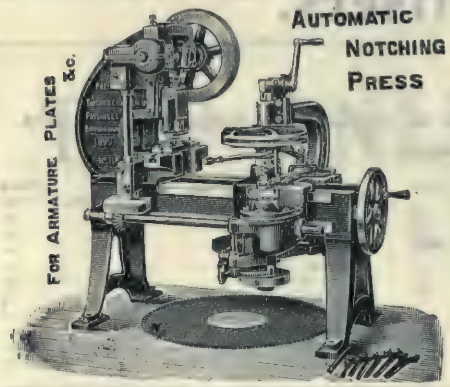

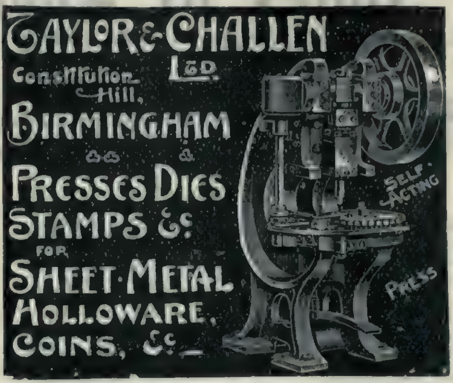
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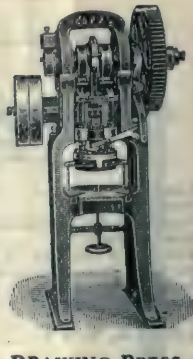

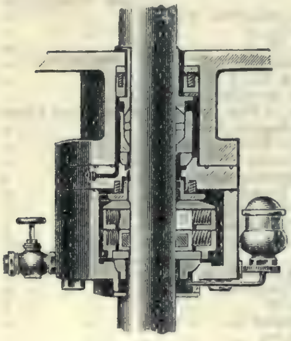

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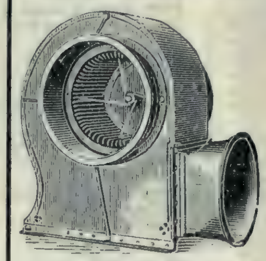

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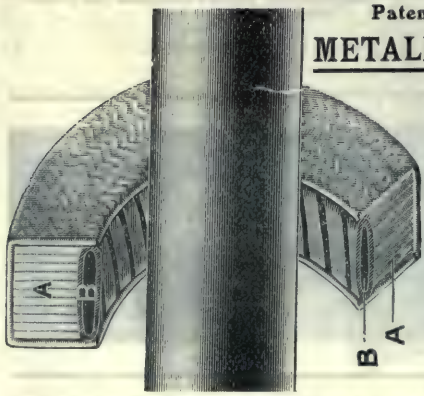

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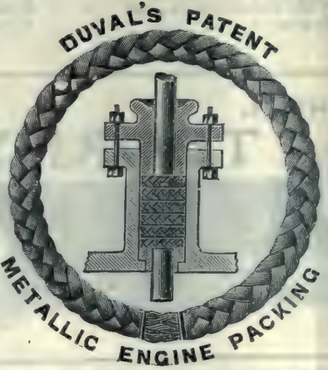

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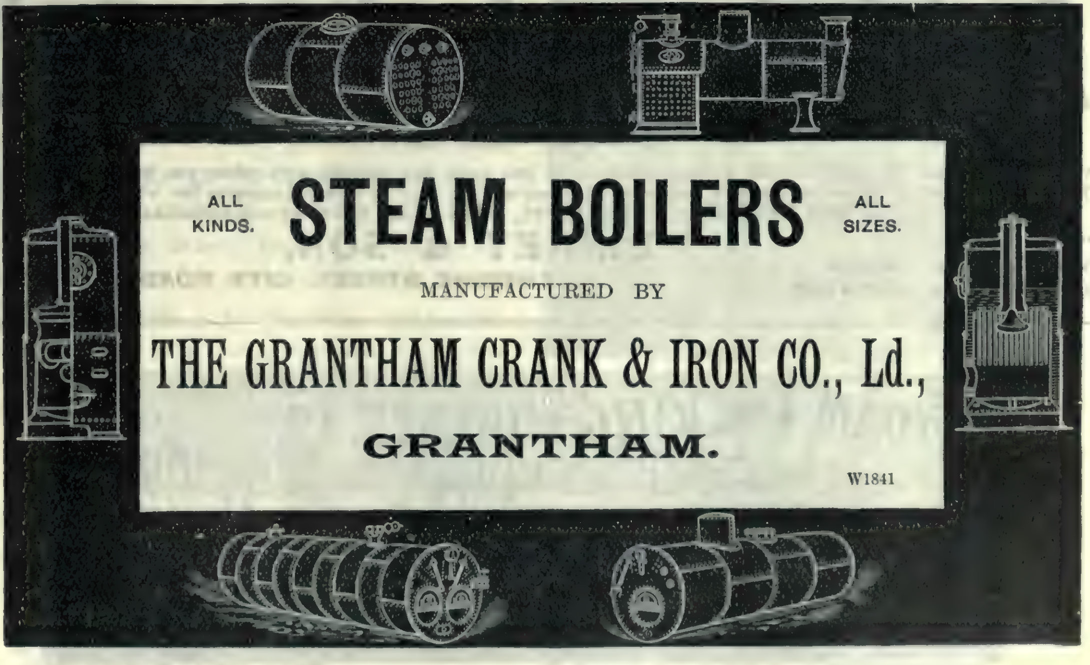

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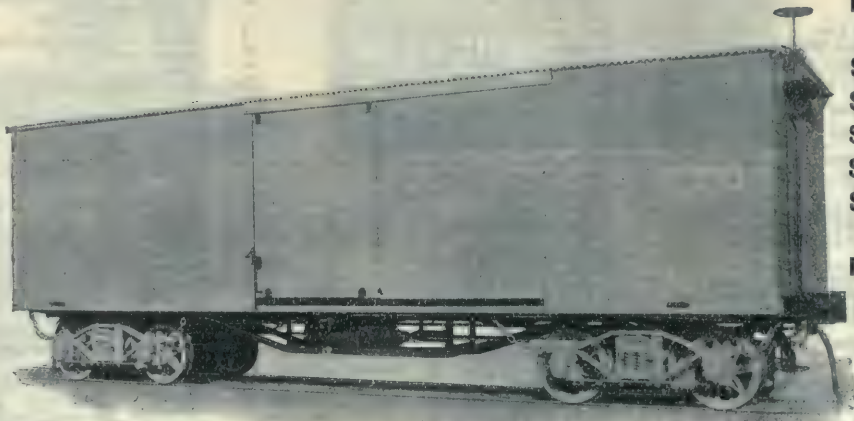

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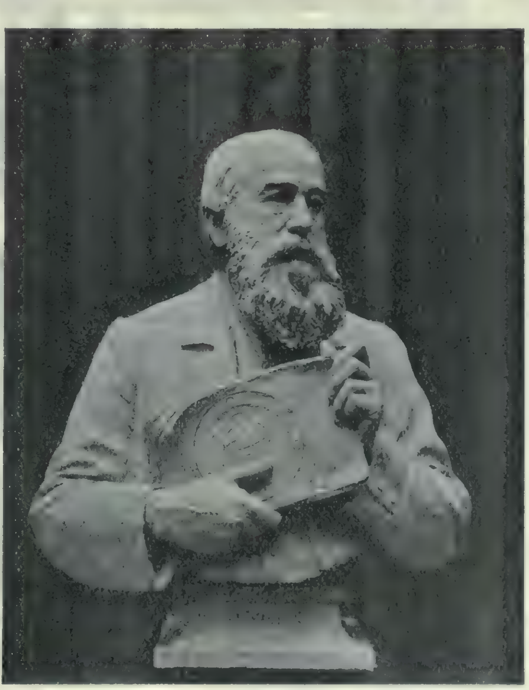
PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, APRIL 21, 1905. No. 32.

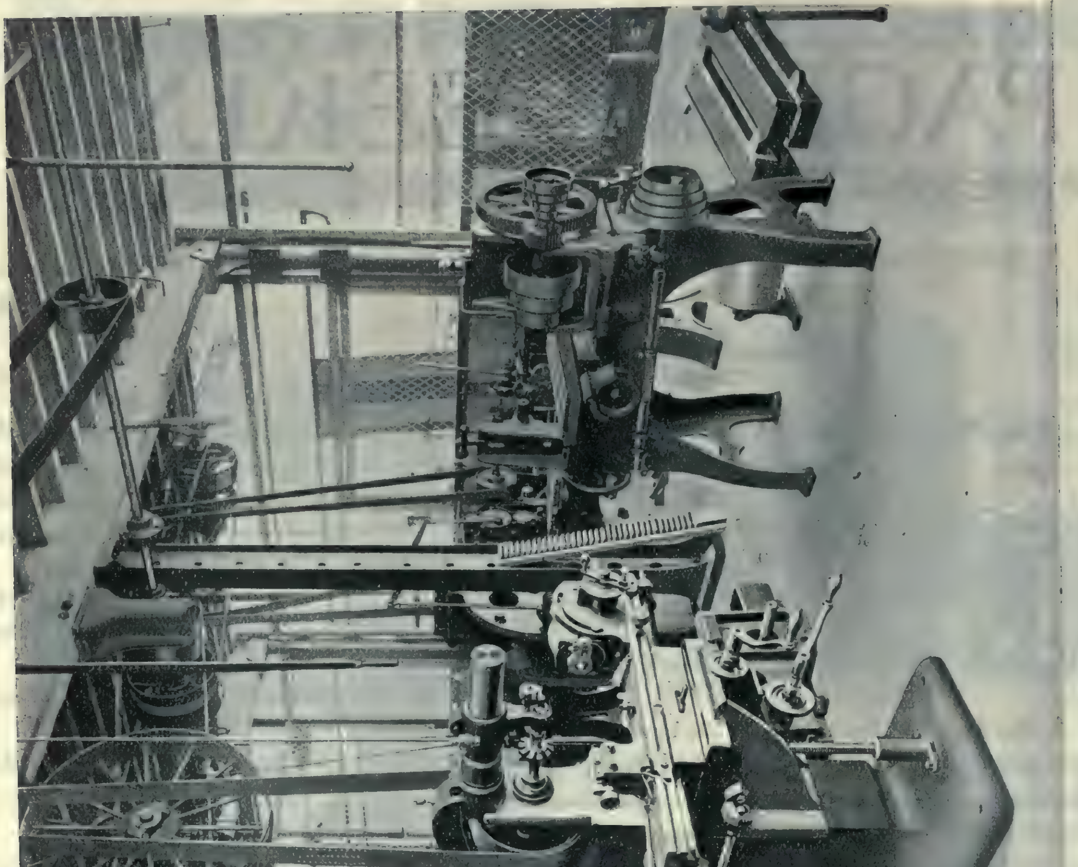
The Offices of "Page's Weekly," Wednesday Evening.

It is no easy matter to sit down and write a presidential address concerning technical matters which will prove acceptable to a large number of workers in the same field, but Mr. E. P. Martin, at the Institution of Mechanical Engineers, drew upon a rich vein of personal experiences when selecting the Dowlais district for his subject matter. As will be seen from the report which appears in this issue it concerned some of the improvements in mechanical engineering which have been applied there to the manufacture of iron and steel. Attention was incidentally drawn to the striking contrast that exists in the areas from which raw materials were formerly drawn for iron manufactures compared with those of to-day. The fuel, instead of being drawn from the hillside at the back of the Dowlais blast-furnaces, is now brought from 3 to 12 miles away, and instead of being practically quarried out from the side of the hill, is now being worked from pits upwards of 750 yards deep, and the iron ore is almost all brought from abroad. The cost of the assemblage of material for the production of iron and steel very properly received attention, Mr. Martin pointing out that the weight of materials required to produce a ton of pig iron varies according to the richness of the ore, from 3½ to 5 tons. While considering the forging of large masses



THE JOULE MEMORIAL.

James Prescott Joule, who established the theory of the mechanical equivalent of heat, was born at Salford in 1818, and died at Sale in 1889. A bronze memorial consisting of a half length figure, four feet high, resting on a granite pedestal, will shortly be unveiled at Sale. The above photo shows the model from which the memorial is being cast. It is the work of Mr. John Cassidy, the well-known sculptor of Manchester, who, it will be seen, has produced a representation of Joule, remarkable for its depth of character and expression.



A WELL-LIGHTED MACHINE TOOL SHOP.

Our illustration shows a large machine tool shop which has recently been completed at the Yorkshire Machine Tool and Engineering Works at Liversedge. During the past six months these works have been to a large extent remodelled, and have been provided with new tools of the latest design, while special attention has been paid to efficient lighting. Improvements still continue to be made, and the offices have been converted into well-lighted rooms with accommodation for four draughtsmen.

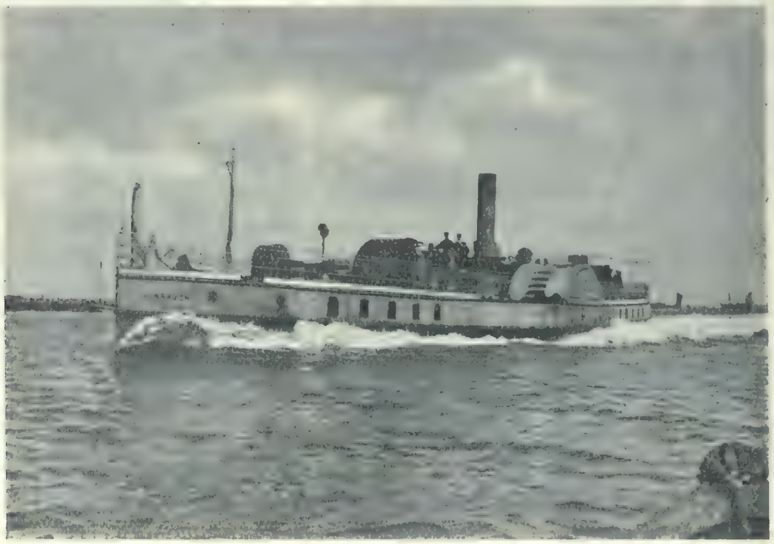
of iron and steel Mr. Martin referred to the impression produced upon him on first seeing the iron pillar at Delhi. This column of wrought iron, he remarked, is 16 in. in diameter, of which 22 ft. are above the ground. It is said to be 50 ft. long and weighs about 18 tons; it is finished perfectly round and smooth with an ornamental top, and was made many centuries ago from iron produced direct from the ore, and built up piece by piece. Remembering the facilities man had in those days for first forging and then welding together such an enormous mass makes one take off his hat to the ironworker of those days, who must also have been a mechanical engineer such as we should wish to know even in these times. It is questionable whether the whole of the iron works of Europe and America could have produced a similar column of wrought iron so short a time ago as the Exhibition of 1851. Other interesting details of this address will be found on page 854.

It will be remembered that some five years ago, in response to the demands of both increasing weight and speed, Mr. Dugald Drummond, the chief mechanical engineer of the London and South-Western Railway, introduced six locomotives having four cylinders all receiving high-pressure boiler steam, the cylinders being arranged in pairs driving the two pairs of driving wheels, which were uncoupled, independently. These locomotives have one important disadvantage, inasmuch as when they are being worked "hard" there is a liability to run short of steam. In order to overcome this defect, says the Statist, several of the locomotives have been fitted with boilers of increased size and greater steam-productive capacity. For the working, during the coming summer of their more important West of England express traffic the South-Western is now constructing five powerful locomotives. These will be of the six-coupled type, fitted with four high-pressure cylinders, two inside the frame, driving the rear coupled axle, and two outside, driving the second pair of coupled wheels. The boiler will have a diameter of 5 ft. 6 in., and is of large dimensions, in order to provide an ample supply of steam in the cylinders. The Walschaert valve gear is to be used for actuating the valves of the outside cylinders, and the ordinary link motion for the inside cylinders.

Sir William Willcocks has been writing to the Egyptian Gazette on the Assouan dam controversy. He summarises his views as follows: "At the Assouan dam we have *against* us (1) the known calculable forces of the water trying to overturn the dam; and (2) certain other greatly minimised but possible forces trying to lift it off its base. We have *for* us (1) the whole weight of the dam, which, with wide factors of safety, is capable of resisting all the known forces by its weight alone; (2) we have a structure built of the most tenacious cement mortar, while in our calculations we have assumed that it is built of mud; (3) we have a rock whose veins are notoriously vertical, and therefore safe, and, moreover, these veins are bounded on either side by solid granite, to which the dam is tied by neat cement mortar thrown in by thousands of barrels, while in our calculations we have assumed that we might have thrown in so much plum jam; and (4) we have a foundation taken down into granite rock, regardless of expense, and supervised in every detail by sound engineers. When, therefore, we are in a position to ward off all the known forces which can come against us, and, moreover, have armed ourselves with extraordinary auxiliaries to help us against all possible adversaries, and have chosen our own ground and deliberately prepared it with ungrudging expenditure of money; when we have done all these things, then, at the critical moment, to be prepared to stand our ground in perfect assurance of success is soldiership in war, and soldiership in engineering." Here is a plain statement of fact in few words which we commend to the attention of the gentleman who made the "alarming discovery" referred to a few weeks ago.

In the paper on "Statistics of British and American Rolling Stock" recently quoted, Mr. Wm. Pollard Digby complains incidentally of the Board of Trade railway returns. If, he remarks, ton-mileage figures be accepted as a guide in any consideration or computation of the internal trade of a country, it is greatly to be deplored that, now that so much attention is given to external commerce, this valuable indicator is not available for the students of British fiscal problems. In this and in other respects the railway returns issued under the supervision of the Board of Trade are woefully defective. They do not permit of adequate comparisons as to the quantity or type of locomotives, or style of rolling stock, or volume of traffic handled, for properly contrasting with those of another country such as the United States. Even so far as the progress of the United Kingdom itself is concerned the railway returns, while presenting certain interesting outlines of the trends and conditions of internal commerce, do not do so with the valuable and suggestive detail found in the returns compiled by the Interstate Commerce Commission, which sits at Washington.

In view of the disagreeable flavour left behind by the recent Holborn Borough Council scandal, we are glad to note the following in the Surveyor: "From a lifelong experience of the procedure of local authorities we are satisfied that the bald facts are that deposits with tenders have not the remotest bearing upon the acceptance or rejection of the tenders, and that their receipt and due return is a mere matter of accountancy which is absolutely mechanical throughout the length and breadth of the country. The instance at Holborn is, an exception, and a rare exception. The official inculpated is not a type; and few and far between as great-auk's eggs must be contractors gullible enough to lay themselves open to criminal proceedings under an impression that the oblation of a deposit and a wink to bribe an official can assist them to obtain a contract." The observations which fell from Mr. Justice Jelf at the trial were certainly calculated to upset some of our preconceived notions, and we trust that this frank and authoritative statement will do something to remove the impression that municipal contracts are hedged around with bribery and backsheesh.



THE PADDLE-WHEEL L.C.C. STEAMER "VANBRUGH." (*See page 847.*)

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Intimation has been received by the promoters of a University for Sheffield that the Committee of the Privy Council have decided to recommend His Majesty to grant a Charter incorporating the University.

The new (No. 9) dock of the Manchester Ship Canal, which H.M, the King is expected to open in the course of the summer, is now completed. The dock, together with the neighbouring transit sheds and railway sidings, has cost nearly half a million sterling. It is 2,700 ft. long, 250 ft. wide, and 28 ft. deep.

The Hodbarrow Sea Wall, just successfully completed, is a work of which Messrs. Coode, Son, and Matthews may feel justifiably proud. It encloses an area of 170 acres and is 1½ miles in length. Its greatest width is 210 ft. at the base and 83 ft. at the top, the extreme height being 40 ft.

The new wall, which was estimated to cost about £500,000, has taken five years to complete. By its erection the company hope to be able to take millions of tons of hematite from under the Duddon estuary.

Tenders are being invited by the Barrow-in-Furness Corporation for the construction of a bridge over Walney Channel, for which Parliamentary powers were obtained last year. The bridge will be 1,123 ft. long and 50 ft. wide, and will consist of eight fixed girder spans and one opening span on cylinder foundations, the opening to be 120 ft. It is expected that the bridge, which will be chiefly constructed of steel, will take from two to three years to build. Sir Benjamin Baker is the designer.

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A New Type of Transformer.

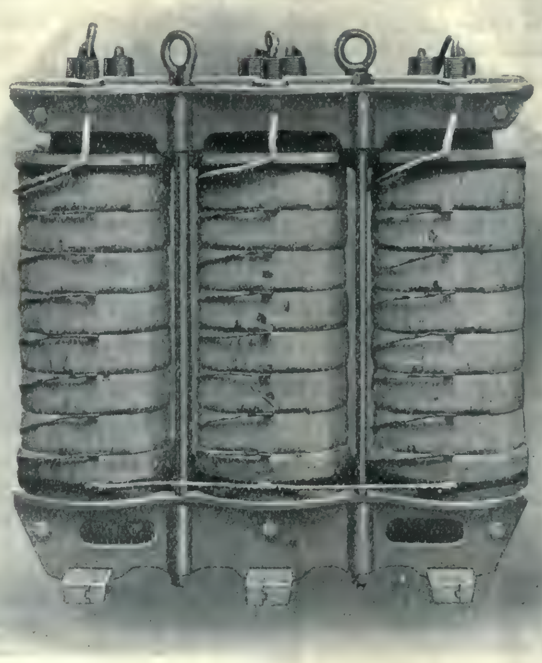
The accompanying illustrations show a type of transformer which departs materially from the the usual practice, and presents several advantages, a characteristic feature being the method employed of interspacing and insulating the coils. In the event of a breakdown the transformer can be easily repaired *in situ*, the damaged coil being merely removed and a spare one substituted. If spare coils and insulation tubes are kept handy a transformer can readily be repaired in an hour or two, and set to work again. The cost of repairing the core is consequently a very small item, only the part of the winding that is actually injured being replaced.

The core is built up of high permeability iron stampings 0·014 in. thick, carefully varnished to insure individual insulation, and to prevent eddy currents, the iron being of low hysteresis loss and practically non-aging. The transformers are arranged with both primary and secondary windings on each limb; the secondary winding is placed next to the core and the primary on the outside of the secondary. The secondary windings of transformers for use on three-wire systems are cross-connected, so that perfect regulation is obtained on each side of the middle wire with unbalanced loads. The primary and secondary coils are each wound independently on formers.

The primary winding is divided into several coils, each coil of which is separately taped with oiled linen. The paper insulation between the layers projects beyond the end of each, thus ensuring immunity from breakdown through short circuit, while the insulation between secondary and iron, and between primary and secondary, consists of special tubes of insulation. Over the iron core is slipped a tube of insulation on which the secondary coil is directly wound. Over the secondary coil is then slipped another tube of insulation, and over this are slipped the primary coils, which are then connected up in series.

The transformers are fitted in a cast-iron oil-tight box, provided with a cover which is bolted to the box. Flexible leads provided with connectors, suitable for taking cables, are brought out through glands in the box. The usual voltages are 2,000 volts primary and 200 or 400 volts secondary, but transformers can be wound for any desired voltage.

The Brush Electrical Engineering Company, 106, Belvedere-road, London, S.E., are building, in addition to the apparatus described, a portable transformer outfit complete with voltmeter, safety switch, fuses, and red indicating lamp, for testing up to a pressure of 10,000 volts.



THREE-PHASE TRANSFORMER WITHOUT CASE.

Monaco Motor Boat Races.

An illustration of the superiority of British marine motors, hulls and designs, is afforded by the result of recent racing at Monaco in the 12-metre racing class. Out of sixteen boats entered only nine were able to cross the line when the gun was fired. Only five boats completed the course, the winner of the first prize of 6,000 francs being *Napier II.*, built by Yarrow, and engined by Napier. The second arrival, *Napier*, built by Saunders, Ltd., of Cowes, with a Napier motor, took a 2,000-franc prize. The Marquis de Jesse's *C.G.V.* came in third, taking a prize of 1,000 francs; she was designed by Mr. J. A. Smith, West India House, London, and received her Thornycroft propeller only the day before the race, so that it was impossible to get her into proper form. *Legru-Hotchkiss*, Saunders-built, was fourth, and *Baby II.*, a Brooke boat, designed as a cruiser, not a racer, by Mr. F. Shepherd, M.I.N.A., Donington House, London, fifth. None of the other boats, which were all of French design and build, succeeded in putting in an appearance at the finishing marks within the time limit.

Institution of Mechanical Engineers.

The annual dinner of the Institution of Mechanical Engineers was held on April 13th at the Hotel Cecil, Mr. E. P. Martin, the President, in the chair. The company included Sir John Wolfe Barry, Sir Percy Girouard, Sir Robert Ball, Sir William H. White, Mr. William H. Maw, Mr. J. Hartley Wicksteed, Mr. Dugald Clerk, Sir W. Arbuckle (Agent-General for Natal), Sir T. E. Fuller (Agent-General for Cape Colony), Sir John Jackson, Colonel F. T. Clayton (Assistant Director of Transport and Remounts), Mr. E W. Richards, Dr. Alex. B. W. Kennedy, F.R.S., Mr. E. G. Burls (Director-General of Stores, India Office), Mr. H. A. Grainger (Agent-General for South Australia), Mr. Alfred Dobson (Agent-General for Tasmania), Mr. W. H. James, K.C. (Agent-General for Western Australia), Mr. F. E. Priest (president of the Liverpool Engineering Society), Mr. B. H. Brough (secretary of the Iron and Steel Institute), Mr. N. J. West (president of the Society of Engineers), Mr. R. Matthews (president of the Manchester Association of Engineers), Professor W. C. Unwin, F.R.S., Professor D. S. Capper, Mr. D. Irving (president of the Institution of Gas Engineers), Professor D. A. Low, Professor H. J. Spooner, Dr. E. Hopkinson, and Mr. E. Worthington (secretary).

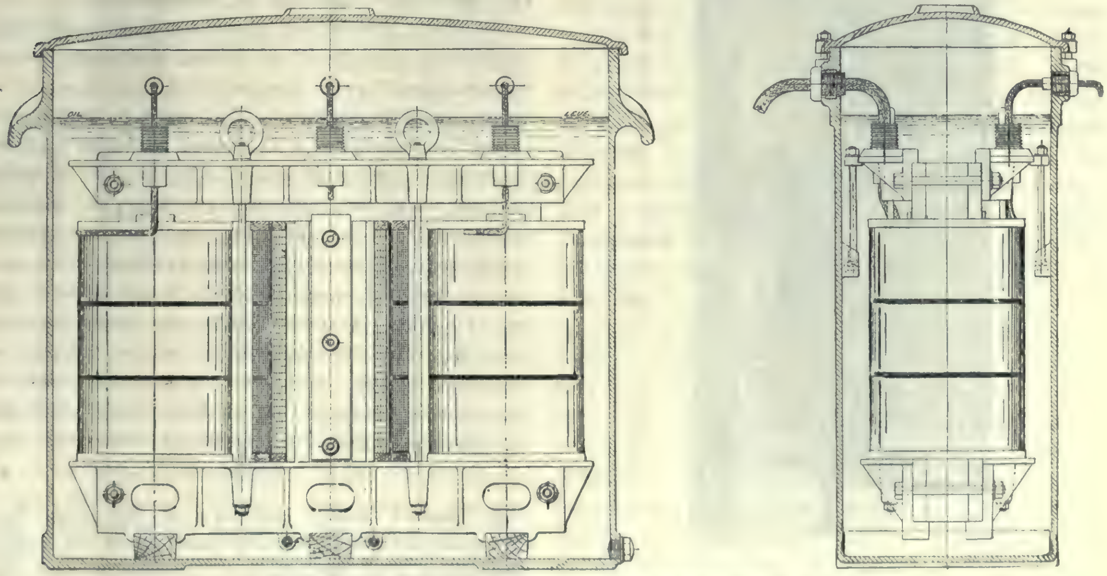
After the loyal toasts had been honoured, Sir Wm. White proposed "Our National Defences."

Major-General Plumer, while recognising the more intimate association between engineering and the navy, with which Sir William White's professional career had been linked, drew attention to the connection between engineering and the army in the transport department. There could be no doubt that the army would adopt mechanical transport, although the process would only be a gradual one.

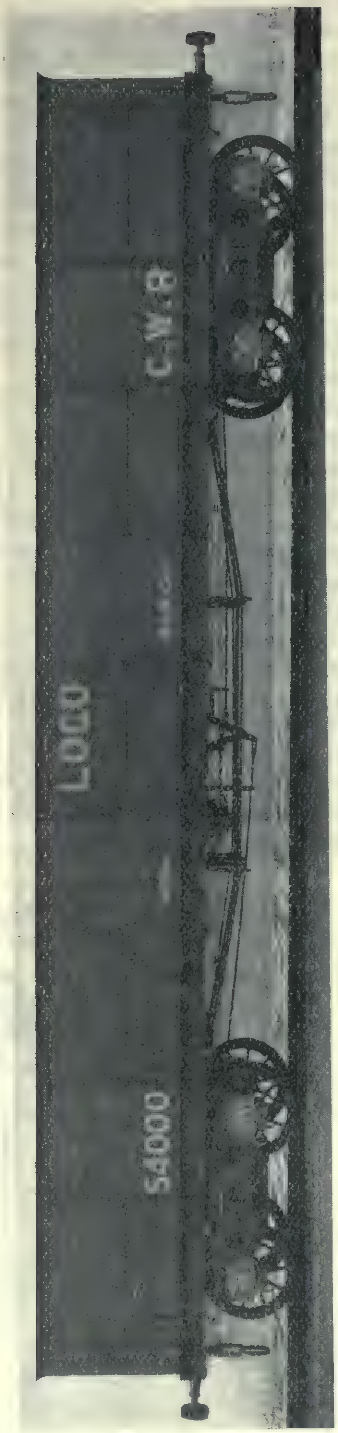
Mr. Wicksteed submitted the toast of "Our Railways." Lord Stalbridge, in responding, claimed George Stephenson as the first engineer who was both a mechanical and a civil engineer. At Euston they had Stephenson's original estimate of the Liverpool and Manchester Railway, dated February 5th, 1825. He quoted several items in it, which totalled up to £400,000, or about £11,765 per mile. They had also many letters of George Stephenson, and hoped one day to ultimately place these interesting mementoes of the early days of railway engineering in a London and North-Western Railway Museum.

Sir Robert Ball, F.R.S., proposed the "Institution of Mechanical Engineers" in a humorous speech.

The President having briefly acknowledged the toast, the proceedings terminated.



SECTIONS OF BRUSH TRANSFORMER—THREE-PHASE TYPE.



LOCOMOTIVE COAL 40-TON WAGON DESIGNED BY MR. G. J. CHURCHWARD FOR THE GREAT WESTERN RAILWAY COMPANY.

A 40-Ton Wagon for Locomotive Coal Traffic.

By courtesy of Mr. G. J. Churchward, locomotive superintendent of the Great, Western, we reproduce a photo of one of the 40-ton wagons recently designed by him for the conveyance of the coal required by the locomotive department at Swindon. According to the Railway News, these coal wagons are of the all-steel type, and are amongst the longest railway coal wagons in use in Great Britain, the principal dimensions being: Length, 43 ft.; width, 7 ft. 9 in., with a depth of 4 ft. 10 in. The wagons, which are fitted with no fewer than five falling doors on each side are carried on two four-wheeled bogies of the "bolster" pattern, the wheels of which have a diameter of 3 ft. 2 in. The distance between the centres of the wheels is 5 ft. 6 in., and the centres of the bogies are 31 ft. apart. The sole bars and longitudinals are 10 in. by 4 in. by ½-in. channel section, each trussed with rods 2 in. by 1 in. and pillar adjustment. The top bolsters are also 10 in. by 4 in. by ½-in. channel section. The cross members are 8 in. by 3½ in. by ½ in. L. section; the side and end stanchions are 5 in. by 3½ in. by 3-16 in. thick, and the floor plates ¼ in. in thickness. Each of these 40-ton coal wagons has been fitted with an effective either-side brake, operating on all wheels. The axle journals are 10 in. by 5 in. It has been found possible to get both bogies on the weighbridges at one and the same time, and the weight is, therefore, taken at one operation. The wagons have a "tare" of 18 tons 13 cwt.—a figure which gives a ratio of "tare" to gross load of about 31·8 per cent.

The Electrical Driving of Machinery.

One of the greatest difficulties in connection with the appilcation of electricity to driving machinery which manufacturers have is to ascertain the size of motor to attach to certain machines. In any case, with direct-current installations, it is always advisable to have the motors compound wound, and in case of intermittent work, such as with punching and shearing machines, as an extreme example, it is necessary to supplement the motor by a heavy flywheel. These are points, however, upon which it is advisable to get expert advice. Transmission in the future in workshops and other factories will be almost entirely by electrical means, and one important point to remember is the quick rate of doing work which frequently results from the adoption of electricity.

Mr. Robert Unwin, secretary of the River Tyne Commissioners, and formerly manager of the mineral department of the North Eastern Railway Company, died recently in Newcastle.

NAVAL NOTES.

Tuesday Evening.

THE changes which have been undertaken in the construction of the armoured cruisers of the *Minotaur* class will not appreciably affect either the rate of progress or the cost of construction, but the first calculations as to the displacement, weight, and tons per inch of immersion will naturally require revision. The changes have been undertaken in order to increase the efficiency of the steering machinery, and will affect the beam of the vessel to the extent of some 8 in. The afterbody has been relaid off and faned on the scrive board, and the shape of the frames and the amount of the beam altered from those positions below the load water line.

The official trials of the *Pathfinder* have been completed with very satisfactory results, a mean speed of 25·38 knots having been obtained, which is ·38 knots above the contract. Moreover, a sa sea boat and as an economical steamer the *Pathfinder* has more than come up to expectations; her radius of action at 10 knots being 6,000 knots.

Speaking at the opening meeting of the spring session of the Institution of Naval Architects, Lord Glasgow made some comments upon naval matters, which I may be allowed to refer to here. Speaking of steam turbines, as applied to vessels of the Royal Navy, he said he thought the speed of the third-class cruiser *Amethyst* had been obtained at the expense of other qualities. At the higher speeds the turbine machinery appeared decidedly more economical in fuel, while at lower power the reciprocating engines had the advantage; at 10 knots speed the *Amethyst* could steam 7·42 miles per ton of coal consumed, while the *Topaze*, a reciprocating engine vessel of the same class, could do 9·75 miles; at 20 knots, on the other hand, the *Amethyst* could run 4·22 miles per ton of coal consumed, to the 2·9 miles of the *Topaze*. These figures certainly deserve consideration, as do the others, on the subject of warship-building in the United States in 1904, which Lord Glasgow also quoted. In the twelve months which ended in December last, the United States launched warships of a total tonnage of 170,885, an amount which has only been exceeded once even in the history of British naval construction.

FRANCE.

The French Minister of Marine has announced that of the six battleships at present under construction two will be ready for commissioning in 1906 and the others in 1907, one in the spring, two in the summer, and one in the late autumn of that year. As regards protected cruisers, he said that two would be commissioned and begin their trials in 1905, two in 1906, and one in 1908. The vote for new construction in 1905 was passed at frs. 121,000,000 (£4,840,000).

RUSSIA.

At the time of writing it is still doubtful what course Rojhdestvensky proposes to take to reach Vladivostok. Only three routes are open to him, through the Tsushima Straits, and up between Korea and Japan, a course that every dictate of prudence and common-sense forbids; through the Tsugarn Straits, another dangerous and unlikely way; and by way of La Perouse Straits, at the north of Yezzo. This last is the only one which offers him any facilities for the accomplishment of his purpose, which is naturally to reach Vladivostok and get his vessels into something like fighting trim after their long voyage. Although we are told that he has taken every precaution since he got into colder waters to have the bottoms of his ships cleaned, they must be rather foul, and his fleet cannot be equal to Togo's in manœuvring capabilities, although in almost every other respect, with the possible exception of personnel, he has the advantage. That it is his object to give battle before reaching Vladivostok we can hardly believe, and that Togo will wish to fight so far south as Formosa, removed as it is from his bases and the only places where he can repair in the event of any of his ships sustaining serious damage, seems equally improbable. Wherefore, it may be supposed that the Easter holidays will pass over unmarked by any sanguinary conflict between the rival fleets. But the early days of May should see the encounter if Togo is fortunate enough to run his opponent to bay, and if Rojhdestvensky in his daring dash for the only remaining Russian port does not succeed in evading the vigilance of the Japanese scouts, which have been in touch with him ever since he passed Singapore.

TECHNICAL SOCIETY NOTES.

EVEN after several meetings the paper on Steam Engine Research read by Professor Capper at the Institution of Mechanical Engineers, can only be considered to have been inadequately discussed. The information it contains will, however, mark it out as one of the standard papers for reference in the library of the Institution. The experiments detailed extended over several years and the results achieved are a high tribute to the patient research of Professor Capper. Although it was work undertaken by the Steam Research Committee the report, as Mr. Maw took occasion to point out, was a one-man report, and that fact should be put on record to the credit of Professor Capper. Outside the paper itself there is a vast amount of information collected during the progress of the investigation, to which it is desirable that adequate publicity should be given.

To some who interposed in the debate, Professor Capper made the "retort courteous." One speaker intimated that unless the paper were read with very great care certain parts of it were open to misconstruction, but as Professor Capper pointed out, it was scarcely fair to base a criticism of a research extending over six years on an assumption that the critic had not troubled to master the contents of the paper. On the subject of leakage, to which a majority of the speakers had directed their attention, the author said that, although a very important branch of the subject, it was, as Mr. Davey pointed out, only an incidental portion of the work, undertaken with a view to following up the researches of Messrs. Callendar and Nicolson on the same subject.

Professor Capper said that he would like to point out in reply to one or two criticisms on the leakage problem that he carefully avoided the assumption of a law in that connection. He believed it was quite impossible to do that unless, as Professor Burstall had suggested, experiments were conducted by a large number of observers on different makes of valves, and a careful comparison made of the results obtained. He also agreed with Professor Burstall that the leakage varied as the temperature, and that valve distortion was responsible for a good deal of the leakage through the slide valve. The subject called for combined investigation.

Something had been said as to the precise lines which further investigation of the subject should follow. He would suggest working the engine as a condensing engine and also to extend the scope of the experiments by varying the ratio of expansion, which, as had been pointed out, had not a little effect upon the question of condensation and re-evaporation in the cylinder. In conclusion Professor Capper made it clear that he did not attach exaggerated importance to his own work, and that he did not wish general conclusions of too wide a nature to be drawn from a research conducted on only one engine and under one set of conditions.

The Effect of Oil on the Ultimate Strength of Boiler Furnaces.

By D. B. MORISON, M.I.N.A.

IT is needless to emphasise the fact that only high-grade steel of medium tensile strength should be used for boiler furnaces. It is equally important that the processes of manufacture should be such as to preserve the physical properties of the steel and maintain a uniform thickness of metal throughout the corrugated section. A difficulty has always been experienced in the manufacture of furnaces from a plate of uniform thickness, by the stretching and consequent thinning of the metal at the crowns and sides of the ridges, but by a very ingenious mill, designed by Mr. Ernest Gearing, of Leeds, it is now possible to roll a furnace of deep section with the sides of the ridges practically normal to the axis and to obtain a thickness of ridge equal throughout to the original thickness of the plate.

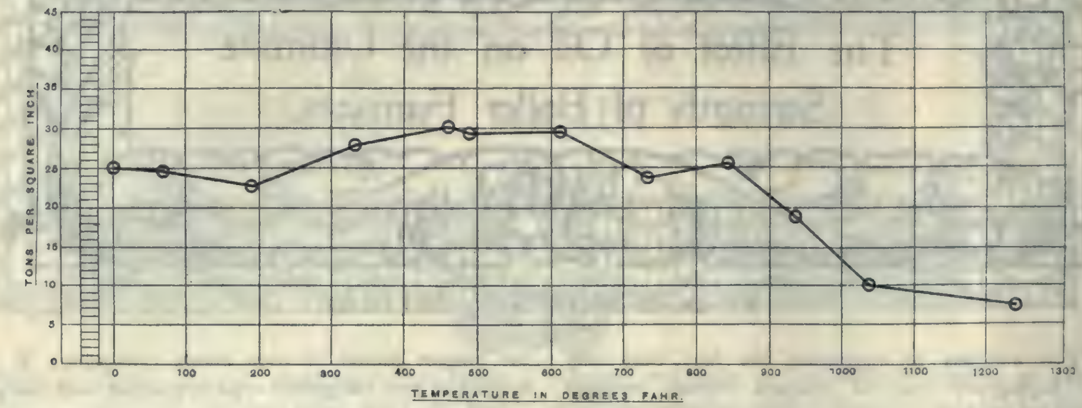
Furnace plates should always be thickened at one end to allow for the thinning during flanging and the flanging should be by hydraulic pressure in dies, especially in the case of the Gourlay-Stephens interchangeable design, as otherwise the material may be so distressed as to induce subsequent cracking.

A furnace is often very severely strained, and is liable to slight deformation, if the tubes are too close to the crown, or if the furnace is otherwise too rigidly stayed. A furnace is subjected to very great variations of temperature, and is consequently always tending to lengthen or shorten, so that, if by faulty design it is not allowed breathing facilities, it will either leak at the landings or alter its shape. Furnace fire-bars should not be fitted in tightly when cold, for obvious reasons. Assuming that attention is given to these points, and that shortness of water does not occur, a furnace collapses only when its wall becomes heated to redness through either oily deposit or excessive scale, so that the safest furnace is the one which will longest withstand the conditions of severe usage, before the metal in any portion of its wall becomes weakened through overheating, and which, having become overheated, will retain its shape for the longest period of time before collapsing. If a furnace of any recognised type is covered with water and is reasonably clean, it will never collapse, as in that condition its resistance is five times greater than the load brought upon it by the steam pressure, but this margin commences to disappear when the temperature of the metal reaches 650 deg. F. and vanishes when the metal becomes red-hot.

EFFECT OF OIL ON BOILERS.

It is only at these extreme temperatures that the capacity of any particular form of furnace to resist collapse becomes effective and apparent; so that the only true measure of the comparative working strength values of different furnace formations lies in their respective resistances to collapse when at the temperature of plasticity. The temperature of steam at 200 lb. is 380 degrees; the temperature at which steel commences to lose its tensile strength is 650 degrees F. and at 1,200 degrees about 75 per cent. of its original strength has disappeared (see diagram). If the surface of a furnace in a boiler for, say 200 lb. pressure, were clean, the temperature of the metal would never reach the point at which its original tensile strength would be appreciably reduced, even under very high rates of evaporation. If, however, the surface were simply rubbed over with a very thin coating of mineral oil, the temperature would at once rise to over 650 degrees, even with a moderate rate of evaporation. An appreciation of this fact will explain many a so-called mysterious collapse of furnaces, in apparently clean boilers. If a mere coating of oil of inappreciable thickness will raise the temperature of the metal beyond the safe limit, it follows that an extremely thin scale or deposit, containing a high percentage of oil, must inevitably result in dangerous overheating. A disastrous accident of this nature came under my notice some time ago, in which the furnaces of a passenger steamer collapsed in mid-ocean; the boat returned to port, the passengers and cargo were transhipped, EXPERIMENTS ON STEEL, MADE BY THE UNITED STATES GOVERNMENT.

DIAGRAM OF TENSILE STRENGTH AT VARYING TEMPERATURES.



and the boat laid up for a lengthened period; the monetary loss, it need scarcely be stated, being extremely heavy.

The boilers were apparently clean, with no appreciable scale on any part. The principal cause of the accident was the use of a very inferior oil for swabbing the rods and lubricating the auxiliary engines. The oil becoming emulsified with the feed water, and being therefore unfilterable, passed directly into the boilers. The deposit scraped from the furnaces and other parts of the boiler was analysed by Mr. J. B. Dodds, of Newcastle-on-Tyne, whose report emphasises the importance of using good and reliable cylinder oil; inexperienced buyers, in their anxiety to obtain a cheap oil, often overlook the vital importance of quality.

Practically no oil is ever present in the harmless-looking deposit found on the crown of a collapsed furnace, simply because the temperature of the plate has been so high as to drive off the oil by distillation, but if deposit is scraped from other parts of the boiler, it will, on analysis, never fail to afford a solution of such furnace accidents as are sometimes termed "mysterious" by those who do not realise the dangerous effects of a very slight coating of deposit rich in oil.

In passenger boats, the source of danger is the auxiliary machinery and particularly the deck machinery, which is often carelessly lubricated by inexperienced men; whilst in cargo boats, the growing practice of using the main boilers for the working of cargo cannot fail to produce accidents, unless great care is exercised and the necessary precautions adopted.

(*To be continued.*)

Outlook on the Rand.

At the annual banquet of the Chemical, Metallurgical, and Mining Society on Saturday, Mr. Lionel Phillips said an increase of 20 per cent. in crushings might be expected as a result of this year's work. He hoped that the experimental plant shortly to be erected at the expense of the whole industry would enable research work to be prosecuted without interfering with the ordinary routine of the mines.

The Rating of Machinery.

At a meeting of users of machinery in London last Friday Mr. Arnold Goodwin, the convener, maintained that, in view of the Exemption Act of 1840 the local authorities were acting illegally in rating plant and machinery inside any premises. A test case had never been taken to the House of Lords, and he urged that users of machinery should combine for that purpose. The cost would not be more than about £3,000. A committee was appointed to fully consider the whole question and report at a subsequent meeting.

Optical Convention.

An Optical Convention will be opened with an address from the president, Dr. R. T. Glazebrook, M.A., F.R.S., on Tuesday, May 30th, and the gathering will extend over the four following days. The mornings will be devoted to papers and discussions. In addition to the papers, demonstrations of apparatus of special interest will be given in the afternoons in the laboratories of the Department of Technical Optics of the Northampton Institute. The exhibition of optical and scientific instruments will be held in the large hall of the Northampton Institute, and will be open daily from 12 to 10 p.m., between May 31st and June 3rd inclusive. Professor Silvanus P. Thompson, son, D.Sc., F.R.S., will lecture on "The Polarisation of Light by Nicol Prisms, and their Modern Varieties."

From a paper read before the North-East Coast of Engineers and Shipbuilders.

THE NEW L.C.C. THAMES STEAMERS.

THE London County Council paddle-wheel vessel *Vanbrugh*, for passenger service on the River Thames, had her official trial on Saturday last, the mean of four runs being taken on the measured mile (nautical) off Purfleet.

The hull and engines have been constructed by the Thames Iron Works Shipbuilding and Engineering Company, London. The dimensions of the ten vessels building by this company are as follows: Length between perpendiculars, 130 ft.; length over all, 134 ft.; breadth, 18 ft. 6 in.; depth, moulded, 7 ft.; draft of water with 500 passengers on board, or a total deadweight of 25 tons exclusive of water in boilers, 2 ft. 9¼ in.

The contract for the vessels stipulates that the above weight should be carried upon a draft of 2 ft. 10 in. and a penalty of £200 for every inch of excess of draft above the specified 2 ft. 10 in. will be exacted, and if the vessels draw more than 3 ft. they may be rejected.

The speed of the vessel is stipulated to be 13 miles per hour, or 11·29 knots, and a penalty of £50 for every tenth of a mile below 13 to 12½ miles per hour, the penalty to be increased to £100 for every tenth of a mile below 12½ to 12 miles, and if the vessel fails to attain a speed of 12 miles per hour she may, at the Council's option, be rejected. The above stipulations are somewhat severe, but were necessary to ensure the Council obtaining the desired result.

A rough profile and plan were submitted by the Council, giving an idea of the style of vessel required, which accounts for the departure from the general type of Thames steamers, the new vessels having a tug stern, that is, the upper works above the counter fall inboard, instead of raking aft. We cannot congratulate the London County Council upon this stern; it certainly does not enhance the appearance of the steamers, and it has the defect of limiting the length of the rudder.

The design of the vessel and engines, with the power required to obtain the stipulated speed, was left to the contractors. At first there was some considerable difference between the proposals, but eventually the two makers of the engines, Messrs. Scott and Co., of Greenock (who are making twenty sets for Messrs. Thornycroft and Messrs. Napier and Miller), and the Thames Engineering Works (who are making the other ten sets for their own boats) have been brought practically into line, Howden's forced draught apparatus being fitted to all the vessels. The engines are of the compound diagonal surface condensing type, with cylinders 16 in. and 31 in. diameter, by 36 in. stroke. The boiler is of the return tube type, with 25 square feet of firegrate, fitted to work at 115 lb. pressure. At a preliminary trial on the 30th ult., with 13 tons of plates on the upper deck, with coals, water, and thirty persons on board to represent the 25 tons deadweight to be carried, it was found that the draft of water was 2 ft. 9¼ in. mean, and a mean speed of 11·517 knots, or 13·26 miles, was obtained. For the official trial on Saturday, the vessel was brought down to her deep load draft of 2 ft. 10 in. forward, and aft.

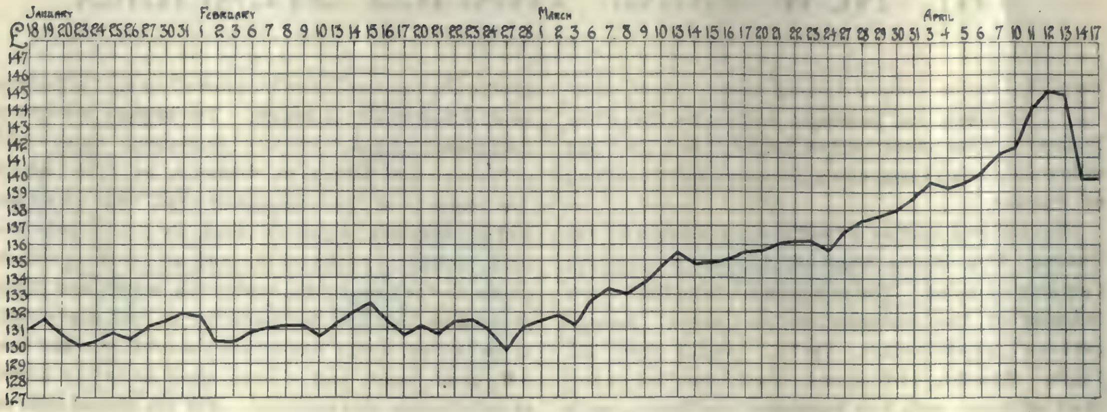
The company's works on Bow Creek, Canning Town, were left at 12.50 noon, and at 1·55 the Purfleet mile was reached, giving a speed of 10·55 knots, or 12·174 miles, for the run. On the mile a mean speed of 11·722 knots was obtained, or 135 miles, being half a knot over the contract speed, with an excess of weight on board of 4 tons, equal to an addition of about 70 passengers.

For the two consecutive hours' trial, it was decided that 58 revolutions per minute should be maintained, which gave the required speed, and this was well maintained throughout, the vacuum being 25 in., steam pressure 110 lb., and the i.h.p. 276·8. On the mile during the four runs the revolutions were 60, and the i.p. 311·8 horses, and the speed 11·686 knots, or about 13½ miles.

A spark arrester has been fitted so that the forced draught fan can still be run at full power with the funnel lowered. An illustration of the *Vanbrugh* appears on page 838.

A circle was turned to satisfy Captain Owen, the Commodore of the fleet, in 2 min. 23 sec. and in about three lengths of the ship. Considering the smallness of the rudder area this was very satisfactory. Two more vessels will be put on trial this week and we are advised that the whole of the ten will be completed by the contract time—May 20th.

The vessel was in charge of Mr. Clement Mackrow, the manager of the Shipbuilding Department; the engines were in charge of Mr. R. Warriner; the London County Council was represented by Mr. H. M. Rounthwaite; and Mr G. C. Mackrow, naval architect and director, represented the Thames Iron Works Shipbuilding and Engineering Company.



FLUCTUATIONS IN TIN FOR THREE MONTHS TO APRIL 17TH.

THE POSITION OF TIN.

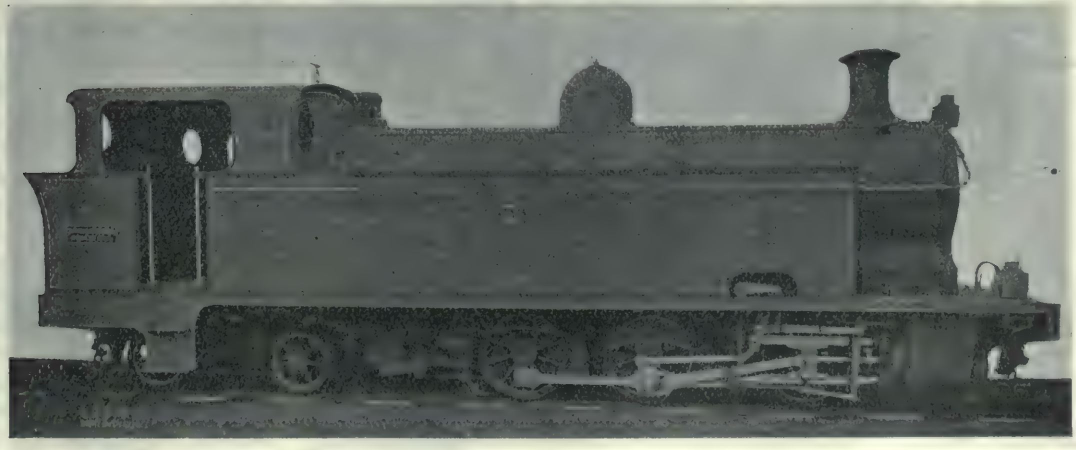
THE tin market has latterly been the focus of metal dealings, and the price has outreached even the predictions of optimists. In a review of the position of the metal published in PAGE'S WEEKLY for December 30th last, it was pointed out that while there was little difference between the opening and closing quotations of the year 1904, tin opening at £134 and closing at £136 10s., there had been a heavy fall to a price of £119 in the summer of last year. The improvement in the position of the metal disclosed at the end of the year 1904, appeared to forecast a further rise in the price of tin. In the last week of the year, the distinguishing features of the situation were an improving demand and a scarcity of cash metal, and it is to these causes that the recent boom in quotations may be mainly assigned. Until the past three weeks the rise in the price of the metal had been almost negligible, the quotation remaining round about £132 for some considerable time. It is only correct, therefore, to attribute some of the history of the past week to mere manipulation. More than once it has been pointed out in this journal that the potentialities of the position were such that a big rise might take place at any time, and it is now evident enough that the gradual shrinkage of supplies during March lent itself admirably to the tactics of those who had been waiting the opportunity to bring about a bear squeeze in spot metal. It was to the strenuous efforts of the bears to close their commitments that the sudden rise to £145 last week was due, and their efforts to get in showed how uncommonly well the decreasing stocks are controlled by the bull party. There has been a sharp relapse from the top price, the closing price to-day being £140 for spot metal and £135 for three months tin, forward metal having shared in the advance to only a very small extent. A fresh rise is probably an event of the very near future, for it is difficult to detect any weakness in the present situation from the bull standpoint. The smaller supplies and the fact that consumption is steadily increasing, do not suggest any permanent relapse in the price of the metal, the sharp decline to £140 being rather due to the relief of the pressure to cover April contracts last week than to any real change in the situation, and there is certain to be a recurrence of the difficulty when contracts have again to be covered. There has been a material reduction in American spot supplies, and there does not seem anything to prevent fresh American purchases in our market, so that it is clear the already small stocks here will experience a further shrinkage.

A Tank Locomotive for the Cala Mines Railway.

A COMPANY was formed a year or so ago for the purpose of working the rich mines of iron ore in the neighbourhood of Cala in the south of Spain. The workings are situated some 60 miles from Sevilla and lie high up in the hills, so that it was also necessary to build a connecting line of railway for the carriage of the ore. A gauge of one metre was decided upon, and owing to the steep gradients a powerful type of locomotive was required. The contract for these was placed with the firm of A. Borsig, at Tegel, near Berlin. The rails weigh 60 lb. per yard, thus permitting a maximum load of 12 tons per axle; but as the curves were as sharp as 5 chains radius, and a large bolier had to be provided so as to admit of a high speed on the uphill gradients, it was necessary to adopt special means to this end. This was arrived at by placing the six-coupled wheels in the front, and a bar frame bogie on American lines in the rear, the main frames being kept down sufficiently low to allow of the firebox being built out over the frame plates. In spite of the comparatively long total wheelbase these engines have shown themselves capable of running with ease and great smoothness over the sharp curves prevalent.

The cylinders are outside the frames and have a diameter of 17 in. and a piston stroke of 19¾ in. The coupled wheels are 3 ft. 3½ in. in diameter, and their bearing springs are furnished with equalising levers. The centre of the boiler is placed 7 ft. ¼ in. above the level of the rails, and has 1,280 square feet of heating surface with a grate area of 23½ square feet. The firebox is of copper, and there are 206 tubes 1¾ in. in external diameter, the distance between the tube plates being 12 ft. 2 in. The working pressure is 185 lb. per square inch. The feed-water is carried in large wing tanks extended forward as far as the smoke-box, and containing 1,100 gallons. The coal bunker is in the rear of the cab, and has a capacity of 1½ tons.

The engine is fitted with the Westinghouse and hand brakes and has also a counter-pressure brake which can be used on running down the steep gradients, thus saving to a great extent the wear of brake blocks on both engine and train. These locomotives are built to equal main line engines, and are capable of taking 180-200 tons up grades of 1 in 50 at a speed of 20 miles per hour.



TANK LOCOMOTIVE FOR THE CALA MINES RAILWAY.

A New Process for the Protection of Iron and Steel from Corrosion.

By Sherard Cowper Coles.

A NEW process is now being introduced for the protection of iron and steel from corrosion, and works have been erected near London. It is a dry galvanising process, to which the name "Sherardizing" has been applied as distinctive from hot and electric galvanising. One point of particular interest about the process is that iron and steel can be coated with a thin even deposit of zinc at a temperature several hundreds of degrees below the melting point of zinc.

The first step is to free the iron from scale and oxide by any of the well-known methods, such as dipping in an acid solution or sandblasting. The articles to be rendered rustless are then placed in a closed iron receptacle, charged with zinc dust, heated to a temperature of from 500 deg. to 600 deg. F. for a few hours and allowed to cool. The drum is then opened and the iron articles removed, when they are found to be coated with a fine homogeneous covering of zinc, the thickness depending on the temperature and the length of time.

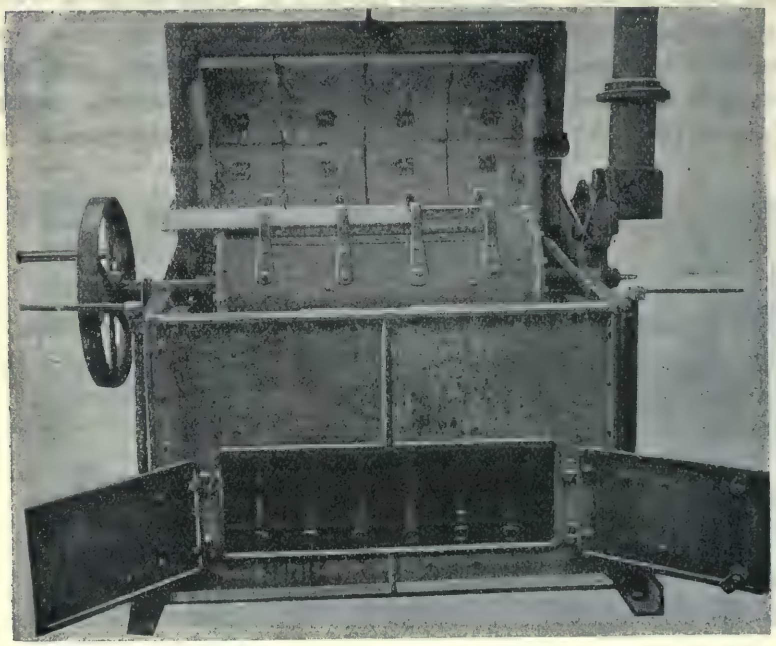


FIG. 1. GAS-HEATED FURNACE.

It will be observed that the temperature required to bring about this result is about 200 deg. below the melting point of zinc. The low temperature required and the economy effected on the zinc consumed make the process cheap as compared to the process of dipping in molten zinc, and has the additional advantage that it does not cause deterioration in iron or steel of small section to the same extent as hot galvanising; moreover, there is no waste of zinc as in the hot galvanising process. The new process is not limited to the coating of iron with zinc, but has been successfully applied to coating iron with copper, aluminium, and antimony. It has also been applied to coating various other metals, for instance, aluminium and copper with zinc. Copper and its alloys subjected to this process are case-hardened on the surface, and can be rendered so hard that they are scratched with difficulty.

DETAILS OF THE PROCESS.

The zinc powder used in the process is the zinc dust of commerce, and must be not confused with zinc oxide. It is obtained during the process of distilling zinc from its ores. Zinc dust at the present time is used for a variety of purposes, and can be obtained in any desired quantity. The average price of zinc dust for the year 1904 was £20 12s. per ton, which is about 5 per cent. below the average price of virgin spelter. The analysis of two samples of zinc dust, such as are employed for Sherardizing, gave respectively 85 per cent. and 85·06 per cent., and 81·86 per cent. metallic zinc. Both samples, when examined under the microscope, seemed to contain small bright metallic beads unevenly distributed through the dust, and it is probable that this may account for the different percentage given by analysis. One of the peculiar properties of zinc dust is that it cannot be smelted or reduced to the metallic form under ordinary conditions, even when heated to a very high temperature under considerable pressure. This property is very advantageous for the new process of dry galvanising, as it does away with the risk there might otherwise be of melting the finely-divided zinc by overheating the furnace.

The receptacle in which the zinc dust is placed and heated is preferably air-tight, and the air exhausted so as to prevent the formation of too much zinc oxide, or if this is not feasible, it is found advisable to add about 3 per cent. of carbon in a very fine state of division. If the percentage of oxide is allowed to increase beyond certain limits, it is found that the deposits become dull in appearance, instead of having a bright metallic lustre, although good deposits of zinc can be obtained from zinc dust, varying considerably in composition. Articles coated with grease receive as good if not a better coating of zinc than those which are free from grease; this fact is of considerable importance, as it enables machine work, such as bolts, nuts, screws, etc., to be thrown direct, after machining, into the Sherardizing drum without any preparation or cleaning.

The articles, when they have been heated in the zinc dust for the period necessary to obtain the thickness of zinc required, can be removed whilst the zinc dust is still hot, although the better practice is to allow the zinc dust to cool to a temperature at which the articles can be readily handled, as the deposit of zinc is whiter and less oxide of zinc is formed. This new process of dry galvanising offers many facilities and great economy to those manufacturers who have not sufficient work to keep a large bath of molten zinc continuously employed. Articles can be Sherardized at a few hours' notice, starting all cold as the drums can readily be heated by gas or coke furnaces, the whole operation occupying only a few hours.

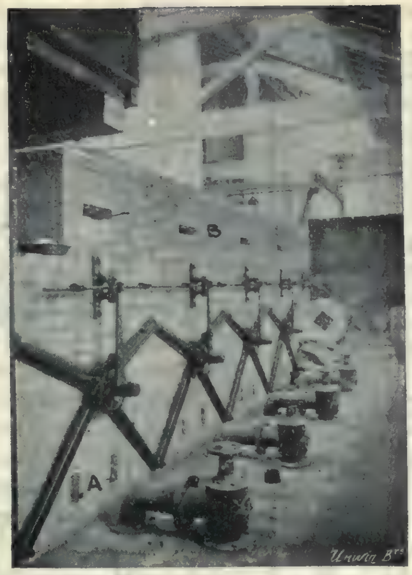


FIG. 4. CONTROLLING VALVES TO FURNACES.

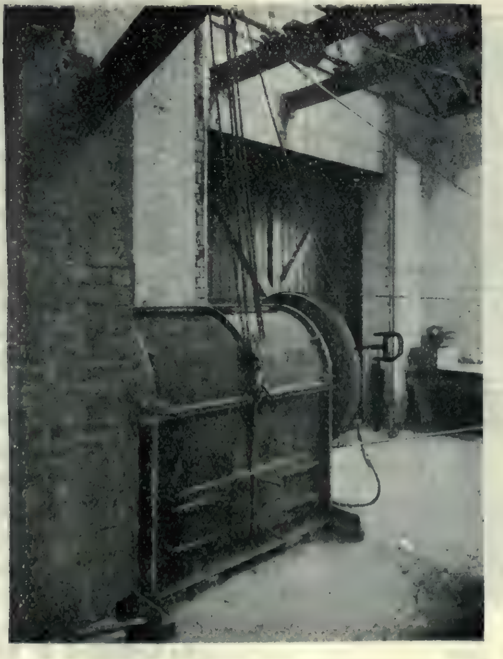


FIG. 2. REVOLVING DRUM FOR SMALL ARTICLES.

A FURNACE FOR SMALL ARTICLES.

A useful type of furnace for small work consists of a closed iron chamber in the form of a cylinder or polygon, and arranged to be rotated or oscillated about an axis. The chamber is provided with an iron door, either at one end or at the side, depending upon the class of articles to be treated. A side door is found to be the most suitable for small articles, such as bolts, nuts, small castings, etc., and the end doors for tubes, oblong or cylindrical articles. In the latter case the cylinder is oscillated on its axis, in the former case it is rotated and provided with baffle plates, to ensure the articles under treatment being turned over and thus becoming uniformly coated by bringing all parts into intimate contact with the zinc dust. Figs. 1 and 2 show such a furnace suitable for Sherardizing one or two cwt, of small articles at a time One of the trunnions is made hollow, so that a pyrometer can be inserted. Below the furnace is arranged a number

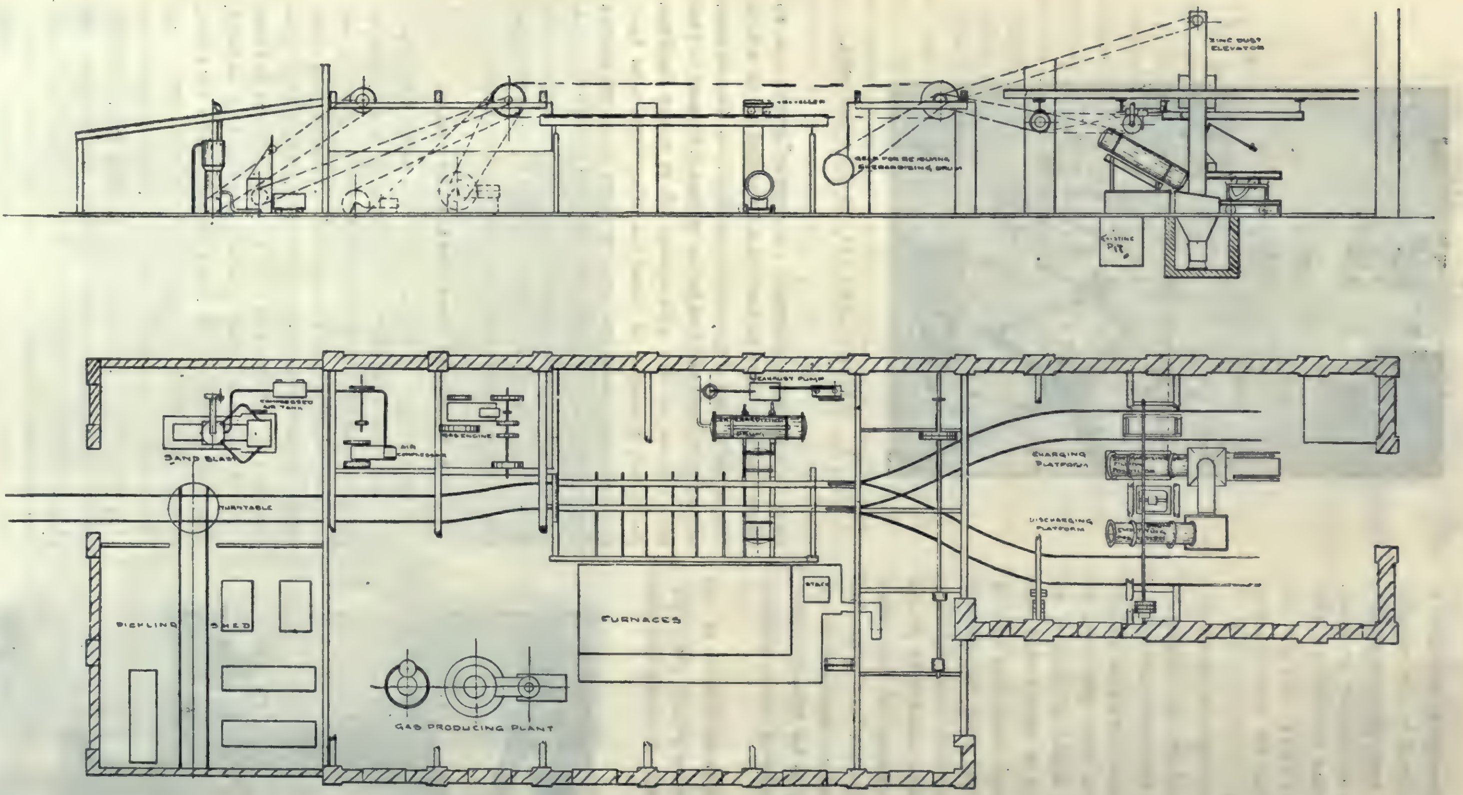


FIG. 3. GENERAL ARRANGEMENT OF PLANT.

of Bunsen gas burners for heating the drum, and the whole is enclosed in a cast-iron shell lined with fire-brick. The drum can be rotated either by hand, intermittently or continuously, by means of a suitable gearing.

The plant required for Sherardizing all classes to work must, of necessity, be modified to suit the different classes of work, for instance if it is required to Sherardize an expanding gate or girder, an iron box would be used which would be kept stationary during the process of Sherardizing, the gate being opened to its full extent during the operation. Tubes require a different construction of drum to the drum required for bolts and nuts, wire and sheets also require modified arrangements to enable the work to be handled expeditiously.

ARRANGEMENT OF A COMPLETE PLANT.

Fig. 3 shows the general arrangement of a Sherardizing plant which has been erected near London, comprising four furnaces, capable of taking drums of 8 ft. by 2 ft., with a cubic capacity of two tons of material

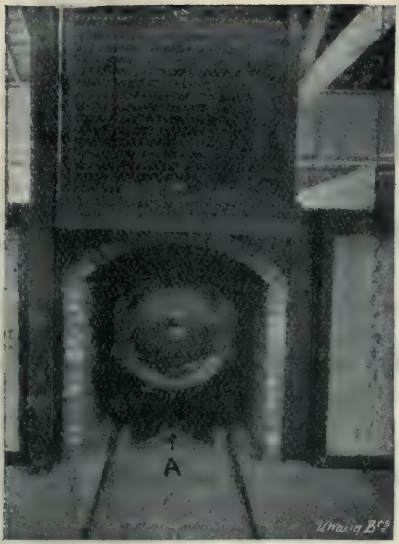


FIG. 5. DRUM IN POSITION IN FURNACE.

at a charge, the weight of iron capable of being Sherardized per charge depending on how close the articles pack. The furnaces are heated by Dowson gas, which is led by iron pipes to the back of the furnaces, the supply of gas being controlled by iron cocks as shown in fig. 4. The gas is then conducted through brick channels through which the air is drawn through the inlets A, the gas being burnt through cast-iron burners A as shown in figure.

The charging of the drum is effected by running the truck on which the drum is placed on to a table (fig. 6); one end is then lowered by means of gearing, so as to tilt the other end, into which the zinc dust is charged from an upper floor by means of a shoot as shown in fig. 6. The drum is being discharged over an iron grating, which allows the zinc dust to fall into a chamber below, from which it is raised by means of a chain elevator to the floor above. When the drum is charged with zinc dust, and the articles to be Sherardized, it is brought into a horizontal position, the air exhausted, and the truck run along the lines until it arrives in front of the furnaces. It is then lifted on to a furnace truck, to effect a saving in the first coat of the plant, and to save waste of heat. The drum is then pushed into the furnace, the door lowered, and the furnace heated up to the desired temperature. When the drum has been in the furnace a sufficient time to give the desired result, the door is raised and the drum and carriage are withdrawn; the drum is lifted on to another carriage, and run out into an open yard, where it is allowed to cool down to a temperature low enough to admit of an easy handling.

DISTINCTIVE CHARACTERISTICS.

The surfaces obtained by hot and cold galvanising and Sherardizing is different in each case, but they can readily be distinguished by those conversant with the three processes. In the case of hot galvanising the surface is spangled, or if not spangled, has the appearance of cast metal. In the case of cold galvanising, the surface is free from spangles, and has a matt or frosted surface, uniform if the work has been well executed. Sherardizing is again distinctive from the two former processes, the general appearance resembles more that of cold galvanising than hot galvanising, but is more lustrous and metallic, and is uniformly distributed over the whole surface, which is not the case with the hot and cold galvanising processes.

In practice Sherardized iron and steel is found to withstand the ordinary corrosive agents galvanised iron is exposed to, to a remarkable degree

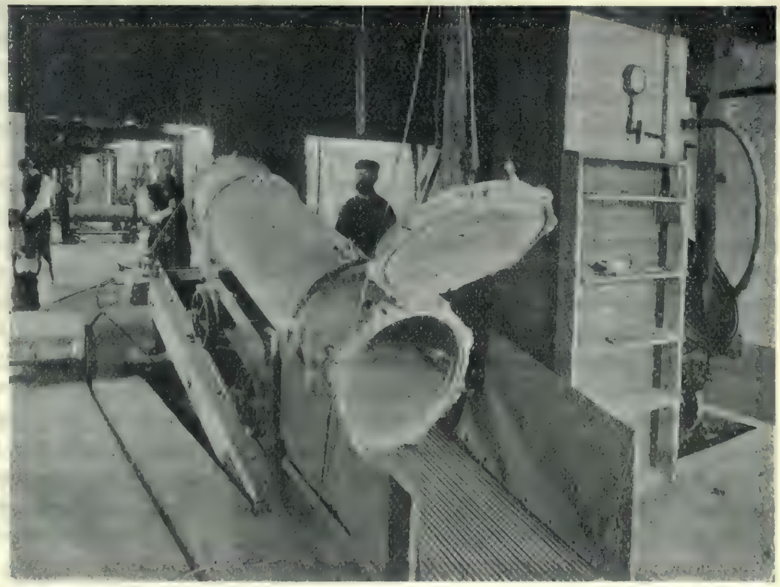


FIG. 6. CHARGING AND DISCHARGING PLATFORMS— SHERARDIZING WORKS.

MR. E. P. MARTIN.

INSTITUTION OF MECHANICAL ENGINEERS.

PRESIDENTIAL ADDRESS.

AT the meeting on Friday last, Mr. Edward P. Martin, the new President, delivered his address, of which the following is an abstract:—

The demand for iron and steel continues to increase, and must increase, at a greater ratio year by year, and if a Royal Commission was considered necessary for investigating our supplies of coal, it is surely as necessary to look into the probable future supplies of our iron ore, as our imports are daily becoming larger, and the known reserves of first-class, cheap ores are diminishing, not only in this country, but in many of the countries from which we draw our supplies. Even Spain is beginning to show that her wealth of ore is diminishing, though as this and other countries in Europe are being opened by railways, far greater supplies are forthcoming, and, fortunately, the enormous deposits of Norway and Sweden are being rapidly largely developed. Recently, processes for concentrating what would otherwise be inferior ores are being carried out on an extensive scale, and will shortly materially assist our supplies, and help to meet the increasing demand for first-class ores. The very important deposits of Minette ores in French Lorraine, Luxemburg, and Germany, form another of the greatest reserves of iron ore Europe possesses. It is very fortunate for the world that the Thomas Gilchrist process has come to our assistance, as it enables these large reserves of second class and other inferior ores to be utilised for the production of steel. This process already provides a large proportion of the world's requirements, and its use will continue to increase in the future at even a greater rate than it has done in the past.

Fortunately for England our cheap steel enables us to build cheap vessels, and so obtain cheap freights, and with cheap freights there is no doubt that all our requirements will be met, as we have the whole world to draw from for our supplies, and even now part of those supplies are being drawn from Cuba, and for special manganiferous and other ores, India on the east and South America on the west, and also New Caledonia in the Antipodes.

It has been pointed out how very important a cheap supply of iron ore is, as without it the cost of our ordinary everyday wants must be increased, much to the detriment of our general welfare and progress. One of the most important factors in obtaining both large supplies, as well as cheap ores, is, as has been said, cheap transport. Our recent visit to the States will have shown you the important advances being made there in dealing with the handling and transport of iron ores, especially on the Lakes.

Our American friends, when called upon to deal with large quantities, seem to recognise the value of specialisation. They deal with the problem without preconceived notions, and are perhaps less bound by old ideas than we are on this side. The Mesabi ore is almost entirely raised and filled by Goliath navvies into wagons brought to the face of the workings, which are run from the mines to the bins at the loading port; from the bins the ore is run out into their specially-built vessels, and on their arrival at the other side is unloaded by special machinery, and carried to the works in Pittsburg in special railway trucks carrying 50 tons each, from which the ore is again dropped into depôts at the blast furnaces, filled into skips, and charged into the blast furnace, so producing pig iron with a minimum of manual labour, and practically without a shovel being used.

A new process which seems to promise remarkable results is Gayley's application of dry-air blast to the manufacture of iron. Those who have had an opportunity of seeing this process at work expect further reductions in the amount of fuel required to make a ton of pig-iron. Still further economies may be expected by the use of steam-turbines for blast-engines, but above all by the introduction and utilisation of blast-furnace gas, and gas from the manufacture of coke, for the purpose of raising power for driving blast and other engines; this is now being followed with the greatest possible interest. The difficulty of cleansing the gas from blast furnaces has now been overcome, greatly reducing the wear and tear of the engines, and blast engines, worked by blast-furnace gas, may now be said to be beyond the experimental stage. Many plants, especially on the Continent, are being entirely driven by engines worked with blast-furnace gas, and it is to these and other improvements that we look to still further reduce the cost of making pig-iron. It is almost a question whether the manufacture of pig-iron may not some day be simply reduced to a by-product by the employment of gas for producing power in electrical central stations.

The importance of central electrical stations for power and light, from which they can both be supplied as rapidly and as easily to the community as gas now is, is only beginning to be appreciated, and possibly the time may come when we may be able to transmit the power thus developed to distant consumers without conductors, as Marconi does his messages. The enormous stride from the telegraph to the telephone is not much more surprising than this would be.

An important invention of great utility, not usually given the attention it deserves, is that of Captain Jones for mixing and de-sulphurising molten pig-iron for the production of steel. The bringing together, and mixing in a large receiver containing several hundred tons of molten metal from the different blast furnaces, often producing different grades of pig-iron, has contributed greatly to the ease and regularity with which the Bessemer process can be worked.

With the introduction of steel, general improvements have been numerous and continuous, and perhaps one of the greatest taxes on the iron and steel maker of to-day is the frequent sacrifices he has to make of what is termed old plant to make room at great expense for machinery that is newer and up to date Most of these changes have taken place since about. 1860, but when discussing the improvements made in this and other countries, it should not be forgotten that most of them originated in this country, though it would not be easy to apportion the credit due to the different men whose inventions are connected with the progress made in the various mechanical appliances in the production of iron and steel.

Another invention from which much may be expected is the Talbot continuous steel process, which enables large outputs to be produced, and from a quality of pig-iron not sufficiently good for making Bessemer and Siemens steel. Furnaces of enormous size have been erected for the Talbot continuous process, some containing as much as 200 tons of molten metal, and turning out an average of over 1,200 tons per week. As has been before stated, the value of this system is that it enables pig-iron of various qualities to be used to advantage and at the same time to produce a high-class quality of steel. It will not surprise those who have had an opportunity of watching this process that it and similar methods may cause as great a change in the manufacture of steel as the adoption of the Siemens furnace has affected the output of the Bessemer.

The improvement in mills rolling steel to-day, compared with the mills rolling iron rails in the sixties, is very striking. The makes of iron rails of about 600 tons per week have now been raised to over 5,000 tons. Instead of the old iron rails weighing about 4 cwt. and being rolled in lengths of 24 ft., ingots are now cast weighing upwards of 2½ tons; they are rolled into lengths of more than 200 ft., and are cut to any required length from 20 to 60 ft. No doubt the principal cause of the increased output is due, among other things, to the larger number of rolling-mill engines employed, as, in the old iron mills they never exceeded two, viz., an engine for the blooming and an engine for the finishing mill, whereas in modern steel-rail mills it is usual to have at least three engines, one for the cogging, another for the roughing, and another for the finishing rolls. In some cases his work has been divided among four or even five engines.

In addition to the engines being made much more powerful than formerly, running faster, using higher pressures of steam, assisted by driven rollers and manipulators, improved shears for cutting ingots) quick saws for cutting rails to lengths, skids for handling the hot rails on the cooling beds, straightening presses, drills, grinds, and other tools for finishing the rails, these with other mechanical appliances, have made it easier to roll 5,000 or 6,000 tons of steel rails per week than it was formerly to make 500 or 600 tons of iron rails per week.

I have already referred to the probable improvements to be effected by the use of blast-furnace gas in gas-engines, but one of the latest ideas, which is about to be carried out on a very large scale with regard to rail mills, is, that the roll shall be driven by motors, whose power will be developed by gas engines driven by the gas from the blast furnaces. The power thus obtained will be delivered as current to motors at the rolls, to which they will be connected by gear, and will supplant the present steam engines now in use for driving these rail mills.

The improvement in plate mills for rolling steel plates is as great as that which has taken place in the steel-rail mill.

While referring to the improvements in making steel plates and rails, one must not omit to mention the great strides made of late years by hydraulic forging. The forging press has been much improved upon. Hydraulic presses of 5,000 and even 10,000 tons are not uncommon, and for working large masses the hyrdaulic forging press seems to have almost replaced the steam hammer. A well-known name in this Institution, Benjamin Walker, had much to do with the progress of this invention.

Another matter that should be mentioned is the progress made in electrical smelting. Although this may not be applied largely to ordinary steel making, there is little doubt that it has a large field open before it for the production of valuable iron alloys.

In the few remarks made, frequent comparisons have been drawn between what is being done on this side of the Atlantic and what is being done in the States. The recent visit of our Institution to that great country must be held as the reason for this. But although calling your attention to their large outputs, it by no means follows that methods and outputs so suitable and successful in the States, with its immense area, great population, and protected markets, would prove successful on this side. The United States are not infrequently referred to almost as though they were of the size and importance of English counties, not as they really are, of the size and importance of European countries. Great Britain, with its area of 120,000 miles and 43 million inhabitants, cannot compare with the United States, with its 3,622,933 square miles (practically the size of Europe), with a population nearly double that of Great Britain, and increasing at the rate of nearly two millions every five years. The requirements of such an enormous new country, with such an active population, can account for a new steel works being laid out to produce 7,000 tons of pig-iron daily, with gas engines to provide 40,000 h.p., and to produce one million tons of steel ingots per annum. In this country the great question would be, not so much how to produce these large quantities, as to dispose of them profitably when they were made. The system in the States of specialising various classes of mechanical engineering has struck most of us. May this not be principally due to the great advantage they possess of having an enormous protected market at their doors?

A SHALLOW DRAUGHT STEAMER FOR THE WEST INDIES.

Messrs. Thornycroft and Co., Ltd., have just completed at Chiswick, the twin-screw steamer *Naparima*, intended for passenger and cargo service in connection with the railway in the Gulf of Paria (between San Fernando and Cedros), Trinidad. The dimensions are: length, 140 ft.; beam, 21 ft.; depth, 6 ft.; draught, with forty-two tons load, 3 ft.

The guaranteed speed with the above load is 13 knots. The hull is constructed throughout of Siemens-Martin mild steel, and all the plates and angles are galvanised. The vessel is divided by transverse bulkheads into seven watertight compartments, *i.e.*, forepeak and chain locker, crew space, fore cargo hold, boiler room, engine room, aft cargo hold, and after peak.

Above the main deck are deck-houses for the accommodation of officers, etc. The promenade deck sheltered by a wood awning, is carried on the top of the main deck houses, and extends for about two-thirds of the length of the vessel. On this deck are placed the steering wheel, etc., forward; a deck-house for first-class passengers, containing dining saloon and refreshment bar, ladies' room, etc. A lift is fitted in refreshment bar to galley below; seats, etc.; gangway ladders are situated forward and in the middle of the promenade deck. Day accommodation is supplied for thirty first-class and one hundred second-class passengers. Two boats are carried on davits above the after-part of the main deck.

The steam windlass, in addition to working the anchors, also operate the cargo cranes, of which there are two, on each side of the boat abreast the hatchways. Steam is also used for steering. The vessel has twin-screws, working in tunnels, and driven by two sets of three-cylinder tri-compound condensing engines, to which steam is supplied by a water-tube boiler, working under forced-draught conditions in a closed stokehold.

On Saturday a representative of Page's Weekly had an opportunity of being present on the occasion of an interesting trial run by the ***Naparima*** down the Thames. After the necessary speed, etc., trials have taken place, the vessel will proceed, under her own steam, to Trinidad. The necessary slight modifications, to comply with Board of Trade requirements, being made.

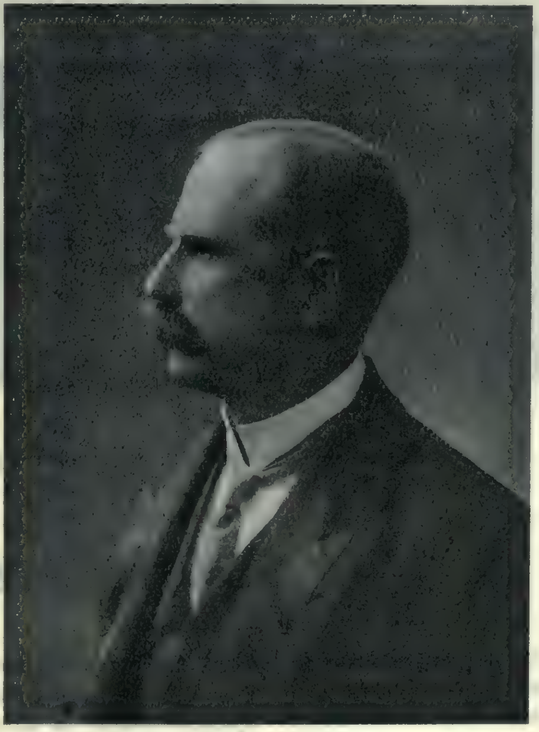
OUR WEEKLY BIOGRAPHY.

DR. J. H. T. TUDSBERY, Secretary of the Institution of Civil Engineers.

DR. J. H. T. TUDSBERY was born October 1st, 1859, at Storeton House, near Parkgate, Cheshire, a member of a migrant branch (settled at Chester late in the eighteenth century) from an old Nottinghamshire family of copyholders, who, by that tenure, held a small estate of one of the lingering historic "peculiars."

Articled in 1876 to Mr. G. F. Deacon—at that time Chief Engineer to the Liverpool Corporation, he enjoyed exceptional facilities during pupilage, including the advantage of two sessions at the University of Glasgow, where, subsequently, he graduated B.Sc.

Of strong physique, he obtained, at nineteen, the silver medal awarded annually to the best gymnast in the University, which for two years he represented in Rugby football. He had considerable academic success, securing distinction in applied mechanics, natural philosophy and geology, and prepared the way to his eventually graduating Doctor of Science.



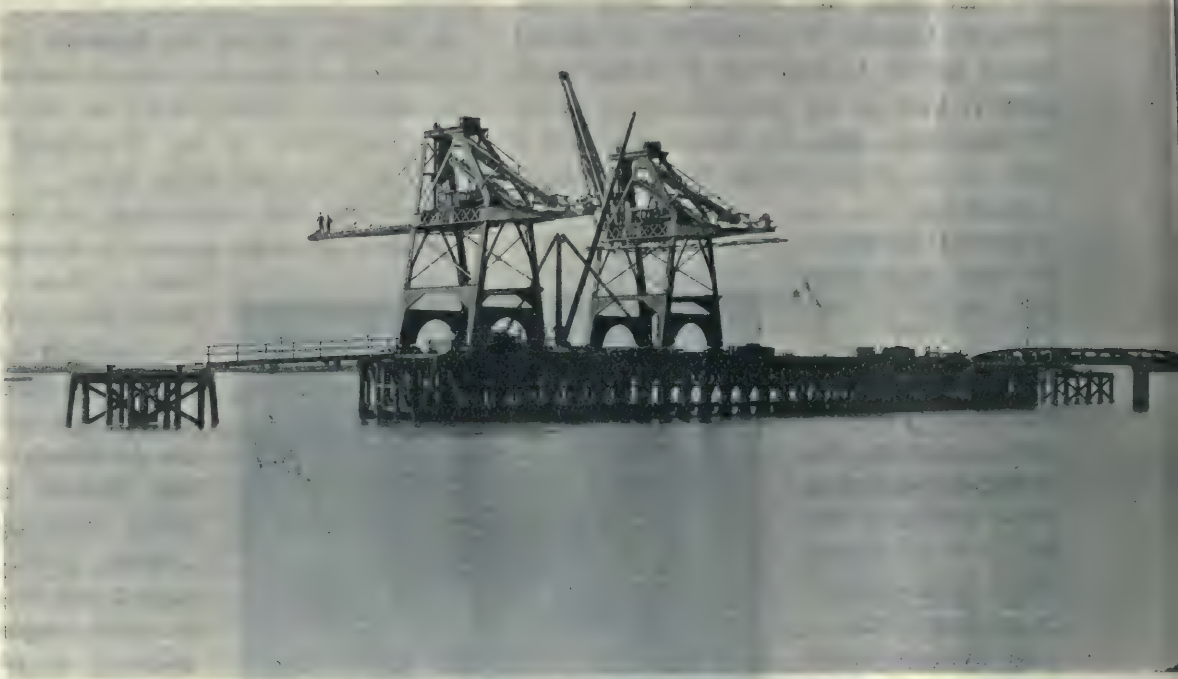
DR. J. H. T. TUDSBERY.

Having completed his articles, he entered the workshops of the Barrow Steel and Ironworks for a period of practical experience, and in 1881 joined the engineering staff constructing the Vyrnwy waterworks, under the late Mr. Thomas Hawksley and Mr. G. F. Deacon.

In 1885 he entered the Imperial Japanese Government service, as principal assistant to Major-General Palmer, R.E., in the design and construction of the Yokohama water supply, and other engineering works.

Completing this engagement, he returned to commence private practice in Liverpool in 1888; there, with other work entrusted, he completed the first engineering survey of the Mersey estuary, for the Mersey Docks and Harbour Board, which, occupying two arduous years, was carried out to a remarkable degree of accuracy, as testified by Mr. J. C. Coode, the Mersey Conservancy's representative.

In 1892 Dr. Tudsbery both became a Member of the Institution of Civil Engineers, and was honoured by an invitation, on Mr. James Forrest's recommendation, to join the staff as assistant secretary. He succeeded Mr. Forrest sa secretary in 1896; his association with the growing activity and responsibilities of the Institution is sufficiently well known to engineers. His and Dr. Brightmore's "Waterworks Engineering" has already passed through two editions.



Photo, Cricks and Sharp.]

Ferro-concrete pier and jetty with bowstring bridge and crane equipment, for

NEW PIER AND JETTY

There are several features which merit attention in connection with the new ferro-concrete pier and jetty erected by the Steamship Owners' Coal Association at Purfleet, on the Thames. The company in question is a combination made with the object of controlling coal supplies from the pit's mouth to the ship's bunkers, and the pier with jetty, and crane equipment, has been built to fill the requirements of an extending trade. In constructing the pier and jetty, the well-known Hennebique system has been employed. It will be noted that the approach pier runs on a sharp curve, but at the same time each span is square with the flow of the river. The construction of the pier is in the form of short ferro concrete girders, similar material being used for the supporting piles and the pier head. The equipment consists of two specially designed Armstrong Whitworth cranes, fitted with duplicate power, each capable of weighing and discharging about 60 tons per hour. Although only two cranes are at present fixed it is ultimately intended to erect four cranes, and duplicate power has been provided for working the two additional cranes. An electric light installation in duplicate has also been put in. Engineering interest centres largely on the 60-ft. ferro-concrete bridge, which in order to give the necessary head room has been constructed as a through bowstring girder, and is shown in

discharging coal from ships. Erected by the Steamship Owners' Coal Association.

AT PURFLEET.

our illustration. Each girder measures 59 ft. 8 in. over all, and is 6 ft. deep at the middle span. As is usual in the Hennebique system, cross bars are inserted transversely at close intervals, and there is the necessary reinforcement of the upper and lower chords. The cross-shaped verticals, 7 ft. long by 5 in. thick, are strengthened by twin vertical bars. No diagonal bracing is used, but iron reinforcement is used for the panel openings. The decking, like the main structure, is of ferro-concrete, and combines with the main trusses to make a monolithic structure. The ferro concrete cross girders are 15 in. deep and 18 in. wide. The upper reinforcing bars have hooked ends reaching to the central sections of the main trusses, and the lower bars replace the transverse stiffening bars employed at intermediate points. The customary sheet iron stirrups are used to provide not only for the main stresses, but to bind the concrete transversely.

The decking is 5½ in. thick between the cross girders, and is strongly reinforced with steel bars. Under the single line of railway which the bridge carries longitudinal stiffening is employed. The total weight of the structure is given as 90 tons, the proportion of steel being one-sixth. The concrete is made up as to four parts of an aggregate, fined down to ¾-in. mesh, and one part of Portland cement.

Vertical Shaft-Sinking on the Witwatersrand.

BY H. FRASER ROCHE.

SHAFT-SINKING by hand has fallen somewhat into disuse since the war, and this, I think, can be safely attributed to our labour troubles. The best sinking by hand labour I believe was done at the Jupiter East Shaft, prior to the war, and the figures from there may be fairly cited as an example of this method of sinking. This shaft was 28 ft. by 8 ft., and was worked in three shifts of eight hours each, the number of boys employed on each shift being from forty to fifty. Each shift, when going on, cleaned out the ground broken by the one preceding it, and then commenced drilling with double-handed hammers. The ground was carried in as many benches as possible, the top bench being often 20 ft. above the sump, which was composed of a four-holed cut. When an average of 3 ft. was reached in most of the holes, they were charged up and fired in the usual manner, the cut coming first. In one month 211 ft. were sunk in this manner with buckets, and an average taken over ten months gave 165 ft. per month. The conditions under which this sinking was accomplished were nearly perfect, the shaft being absolutely dry, the boys (O. R. C. Basutos) excellent, and the three contractors among the best miners to be found in this country. The timbering was carried out in the usual manner, and always kept at least within 30 ft. of the bottom of the shaft. The total cost averaged approximately £20 per ft. The great influx of unskilled labour may probably cause many of our engineers to revert to hand labour wherever possible, as this is undoubtedly the cheapest and most rapid means of sinking, but to obtain a footage anything like the Jupiter, it would be necessary to have picked hammer boys or Chinamen and also fairly good ground and no water.

THE SOUTH NOURSE SHAFTS.

In the sinking of vertical shafts by machines many different methods have been employed with varying success, and it will be best to take actual cases to demonstrate these. The equipment of the South Nourse shafts is probably the best in use to-day, their permanent winding engines and headgears having been erected. The engines are 1,000 h.p. Whiting hoists, equipped with drums. The size of the shafts is 32 ft. by 8 ft., divided into five compartments, three of which—the two end and centre ones—are not used for hauling ground. The remaining two, Nos. 2 and 4, are fitted with 2-ton self-tipping skips, with steel shoes on wooden runners. One end compartment is used for pumps, air main, and ladder-way, and the centre one being kept entirely free, greatly adds to the convenience of timbering, since it can always be staged.

Sinking operations are conducted as follows: Six small machines of 2½ in. diameter, on six bars, are in use, each tended by one white miner, with native or Chinese helpers. Forty to fifty holes from 4 ft. to 5 ft. in depth are drilled over the bottom of the shaft, their position, of course, depending on the state of the ground to be broken. These are then blasted, and cleaning begins as soon after as possible, the first skip of ground being hauled in from thirty to forty-five minutes. From ten to fourteen lashers are employed per shift, which varies in duration with the ground broken, but two shifts are usually sufficient for each round. The timber is similar to that ordinarily used in deep level shafts, viz., wall plates, dividers, end plates, and studdles. The wall plates are morticed to receive the studdles and dividers, each divider effectually blocking two studdles at each end. The whole sets are blocked in the ordinary way with the sides of the shaft. The use of skips necessitates the timber being kept within 30 ft., or thereabouts, of the bottom of the shaft. The bottom wall plates are cleated with sheet iron to protect them against the blasting, but these are capable of rapid adjustment and removal.

Two sets of wall plates are lowered in quick succession beneath the skips, and the hanging is operated from the last blocked set, and the bottom of the shaft. The runners are kept as close as possible to the bottom set in position, and below this, temporary runners in 6 ft. lengths are used, thus allowing the skips to reach the bottom without the shoes leaving the runners. Bearers are placed at suitable and regular intervals. The proximity of the timber to the bottom of the shaft is of great value in rapidly removing the smoke and gas after blasting, since ventilating pipes can be carried down to the bottom set and connected with a fan at the bankhead. Till October, 1904, the South Nourse held the record for shaft-sinking with machines.

AT THE VILLAGE DEEP.

Another method is that employed at the Village Deep, in the Western shaft. A double direct-acting engine (Tangye), 250 h.p., is used with buckets. This engine has been augmented by a smaller geared Fowler hoist and bucket. The buckets run in crossheads with steel shoes on wooden runners. The tipping process with these buckets is far inferior to the skip method. The three centre compartments are used for hoisting, the Eastern one for pump, air main, and ladder way, and the remaining one kept clear. The sinking is carried on as follows :—

Four bars are rigged—two of them 1 ft. to 3 ft. from the end of the shaft, and the other two 7 ft. from each of these. Three 3¼-in. Ingersol-Sergeant machines were used on each bar, each side machine drilling three holes, the centre ones drilling three also, but sometimes one of these was omitted when the ground allowed. These were tended by eight white men with native helpers. The cut holes are drilled 10 ft. deep, and the side 8 ft. to 9 ft., all being started with star bits and completed with a succession of chisels, the average time taken during October for drilling being eight hours. All were then charged and blasted together, this blast generally breaking 4 ft. of ground. Cleaning down the timbers could not be started for fully an hour afterwards, owing to the bad ventilation, and an hour and a half generally elapsed before the first bucket of ground was hauled. Eighteen lashers were employed per shift, and three shifts per round.

When the 4 ft. referred to was cleaned up, the sumps of the old holes from the first blast were cleaned out by compressed air, and all charged again and blasted, after which similar cleaning operations were proceeded with. The average depth per round cleaned during October was 7·5 ft., twenty such rounds being drilled, blasted and cleaned up during the month.

The average time per round during the month was 37·4 hours, 4,200 tons of ground were hauled, and ·96 lb. of dynamite was used per ton of ground hauled. In all, 150 ft. was sunk and timbered during October, and in spite of conditions far inferior to most other sinking shafts, a world's record was created for machine sinking.

The Village Deep shaft was laid out to consist of a pump and ladderway compartment 6 ft. 6 in. by 6 ft. 6 in., and four hoisting compartments 5 ft. by 6 ft. 6 in. inside timbers. The timber consisted of the usual wall plates 30 ft. 4 in. by 9 in. by 9 in., end plates 8 ft. by 9 in. by 9 in., sets 6 ft. vertical centres, corner studdles 8 in. by 8 in., other studdles 9 in. by 6 in., and dividers 9 in. by 7 in. All timber was pitch pine.

Owing to three centre compartments being used for hauling, the blocking and fixing of dividers in position had mostly to be done while drilling operations were going on. Thirty feet of wall plates were hung on each side at a time, that is, ten wall plates were hung in succession. All wall plates were suspended from the rope of the centre compartment (the bucket being first removed), lowered and swung in position by a rope at each end, and hung on four 1⅛-in. hanging bolts from the set above. The actual hanging of wall plates seems at first a difficult and dangerous operation, but with skilled timbermen great speed is attained, the average time per wall plate being five minutes. The hanging of the wall plates was always arranged to take place after the second blast, for the machines, bars and gear for drilling were lowered before the second clean up was actually finished.

The blocking of the sets, and placing studdles and dividers in position followed as soon as possible, and as the last timber set was completed, new wall plates were lowered. Wooden runners 8 in. by 4 in. in 30 ft. lengths were used in the three winding compartments and were kept as close as possible to the bottom of the timbers. Sets of six single bearers were placed in suitable positions, at fairly regular intervals, of 80 ft., in deeply seated hitches; the end bearers being 14 in. by 9 in., and the centre 14 in. by 7 in.

These being in position and sets blocked, the hanging bolts above the bearers were taken out. The timber was on an average 60 ft. from the bottom of the shaft. This gear was designed to carry 4-ton skips on 60-lb. rails, 4 ft. 4 in. gauge, with guide rails of same weight, 2 ft. gauge. These rails are riveted on cast-iron brackets, 6 ft. centres and through bolted to the dividers. The distance pieces used were 9 in. by 2 in. These rails have been placed in the Village Deep No. 1 shaft, and have been found highly satisfactory. 10,300 ft. of rails were placed in position in nine days.

On several occasions strong feeders of water were passed through and gave rise to a lot of trouble. These were dealt with by placing water rings at the first timber sets below the feeder, and then blocking the set as closely as possible to the sides of the shaft. Good strong clay was then tamped into the crevices, thus making a watertight joint with the sides of the shaft. If necessary the spaces between the studdles were raised 3 in. by means of closely fitting slats. The whole ring was then surfaced out and tamped with clay, and given a slight fall toward the pumping compartment, where a 2-in. pipe was placed in the ring, leading to a 600-gallon tank, which formed the sump for a suitably sized pump. A good deal of water was encountered in this shaft, it being found necessary to ring it at the 300, 600 and 800 ft. levels, and Knowles' air pumps were used in connection with tank sumps at these points, with a sinking pump always at the bottom. A big break with N. and S. strike dipping 80 deg. east was met with at 400 ft. down, but left at 700 ft., and this gave rise to most of the water. At the 1,000 ft. level a big pumping station and sump were cut, the excavation amounting to over 700 cubic yards. The break was again encountered in the excavation and a strong timber and clay dam was built forming a sump of 50,000 gallons capacity. A Riedler air pump, 25 h.p., with reheater was put down with a Gould electrical pump as a stand-by and an 8-in. column takes all the water from here to the surface. At 1,200 ft. another large feeder of water was cut and successfully ringed, and led into a 600-gallon tank which formed the sump of a 16-in. by 8 in. Knowles' pump. At 2,120 ft. a similar station to that at 1,000 ft. is being cut for the reception of Rielder and Gould pumps. During the last six months an average of 3,500 gallons of water per hour has been brought to the surface.

(*To be continued.*)

Read before the Chemical, Metallurgical, and Mining Society of South Africa.

Shipbuilding Notes.

ON Monday, the 10th inst., the steel screw steamer *St. Patrick*, built by Messrs. Craig, Taylor and Co., Stockton-on-Tees, to the order of Mr. A. O. Wilson, of Gothenburg, was taken to sea for her loaded trial trip from Sunderland, which proved highly satisfactory. The dimensions of the vessel are 316 ft. by 44 ft. by 22 ft. 6 in. depth moulded. The engines, which have been constructed by the North-Eastern Marine Engineering Company, Ltd., Sunderland, have cylinders 22 in., 36 in., 58 in., by 39 in., with two large steel boilers working at 180 lb. pressure. During the whole of the run everything worked with the greatest smoothness, and an average speed of 11 knots was obtained.

The *Madonna*, a large twin screw steamer, which has been built by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., for the Richmond Steam Shipping Company, Ltd., of Liverpool, completed a very successful series of trials off the coast on Saturday, the 8th inst. The steamer is 430 ft. in length by 48 ft. beam, and has been built to attain the highest class in the register of the Bureau Veritas. The propelling machinery, consisting of twin-screw triple expansion engines, has also been constructed by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., and on the trials, worked without the slightest hitch, giving satisfaction to all concerned and driving the vessel at a mean speed of 17½ knots per hour. The steamer is intended to run in the emigrant service to New York, and has also very complete accommodation for fifty first-class passengers, and about 1,700 emigrants, for whose comfort nothing has been omitted.

On Monday, April 10th, the large steel screw steamer *Euston*, built by R. Craggs and Sons, Ltd., Tees Dockyard, Middlesbrough, for Messrs. Wesbster and Barraclough, of West Hartlepool, proceeded to sea for her official trials, The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of 11¾ knots in half-laden condition. A special feature of the construction is the clear holds. The deck machinery consists of nine powerful steam winches, and very large marine type donkey boiler. The water ballast arrangements provide for a maximum of nearly 1,000 tons, and the accommodation for ship's company, including apprentices, has received special attention. The engines have been fitted by Messrs. Blair and Co., Ltd., of Stockton-on-Tees, having cylinders 25 in. 41 in. 67 in. by 45 in. stroke. Steam is supplied by two large single-ended boilers working at a pressure of 180 lb. to the square inch.

GERMAN COAL AND IRON IN 1904.

THE Foreign Office has issued a report on the trade of Germany for the year 1904 by Mr. Consul-General Schwabach. This states that the economic recovery which characterised the last months of 1902 and the whole of 1903 continued steadily in the first half of 1904, but in the second half a gradual falling-off became apparent, and in the coal mining and iron industries the situation at the end of the year was less favourable than six months or even a year ago. Decidedly disappointing was the condition of the iron, and more particularly of the pig-iron, industry, and in a measure, of the coke and coal industries. The inland demand is slowly increasing after the collapse in 1901, but it has not approached the record of 1900. The considerably reduced home consumption placed the pig-iron works before the alternative of either reducing their output by a third or even more, or forcing the exports by sacrificing profits. They chose the latter course. The exports of iron and manufactures of iron were largely effected at prices which left very small or no profits at all to the works, the benefit falling chiefly to the workmen who could be kept employed and whose wages could be maintained. With but a slowly increasing inland demand and a greatly reduced export trade the record production of 10,086,000 metric tons of pig-iron in 1903 was only just maintained in 1904, and the increase in the output of coke, and also, to a corresponding degree of coal, was smaller than in the two preceding years.

CORRESPONDENCE.

Leeds, April 7th, 1905.

To the Editor of PAGE'S WEEKLY.

DUST IN BLAST FURNACE GASES.

DEAR SIR,—In the interesting article which appeared in a recent issue we observe a reference to the difficulty experienced in ridding blast furnace gases from dust before utilising them for driving engines.

We are now manufacturing in connection with our well-known destructor plants an improved form of dust-catcher, which we are convinced would be equally suitable for clearing dust from blast furnace gases as it has proved itself to be in clearing the dust from destructor gases. The dust-catcher depends upon centrifugal action and has no moving parts. It may be constructed either in metal or brickwork, but we usually find brickwork preferable.

We should be most happy to send particulars of our patent dust-catcher to any of your readers who may be interested therein.

Yours faithfully,
For the Horsfall Destructor Company, Ltd.,
F. L. WATSON,
Assoc.M.Inst.C.E., General Manager.

MOTOR NOTES.

THE NEW BROOKE CAR.

THE 35-h.p. four-cylinder car is the latest production of J. B. Brooke and Co., Ltd. The engine is termed 35 h.p., but the engines having a bore of 5½-in. by 6-in. stroke, the power developed at the normal speed of 1,000 revolutions per minute is said to be over 50 h.p.

Each cylinder is cast separately and bolted to an aluminium crank chamber, which in turn is coupled direct to the main frame. The crankshaft is hollow throughout. Ignition is by low tension magneto, the break being on the usual Brooke principle of falling vertical lever and angular surfaces. The igniters are placed immediately over the induction valves. Water cooling is by means of a large honeycomb radiator, with chain-driven free wheel fan, the water being taken in just over the exhaust valves and discharged over the induction valves. The carburetter is of the Brooke automatic type, but differs from the 20-h.p. form in that it is water-jacketed. The clutch, fig. 1, is of novel design, of the metal to metal type, but different to other forms of car clutches. A loose ring is supported on the clutch body, and is cast with an elliptical hole therein, into which fits an elliptical plug; a slight movement of this plug by means of a lever attached exerts enormous leverage on the ring, expanding same into the internal portion of the clutch and makes practically a positive drive, although the force required to withdraw it is infinitesimal, and the clutch can be engaged so gently that the engagement is hardly perceivable. Between the the clutch and gear box is interposed a flexible joint similar to that used on the 20 h.p. car. The gear-box illustrated in fig. 2 shows that the gears have really exceptional width and are of large proportions. Three speeds and one reverse are provided, the top speed giving a through drive.

The speed lever is arranged on the limit principle, so that the lever comes to a positive stop at each speed, and the reverse can only be obtained by pressing a knob on the speed lever to allow it to go into its particular pocket. Two sliding rods are provided in the gear-box, and these rods are countersunk at neutrals and speeds in; into these countersinks a ball is pressed by means of a spring, so that when neutral is reached, the speed rod is held there and so with the speeds in; moreover, these countersinks and spring balls send each speed in with an unmistakable "flip." Ball race countershaft brackets are fitted beyond the powerful differential, and from these the power is transmitted to the road wheels by small pitch chains of great breaking strain. All the road wheels are fitted with Hoffman ball bearings, that being four ball races to each axle box, two of which take the actual bearing and two the side strains.

The wheel base is 9 ft. 6 in., and the back wheels 875 by 120, and the front 870 by 90.

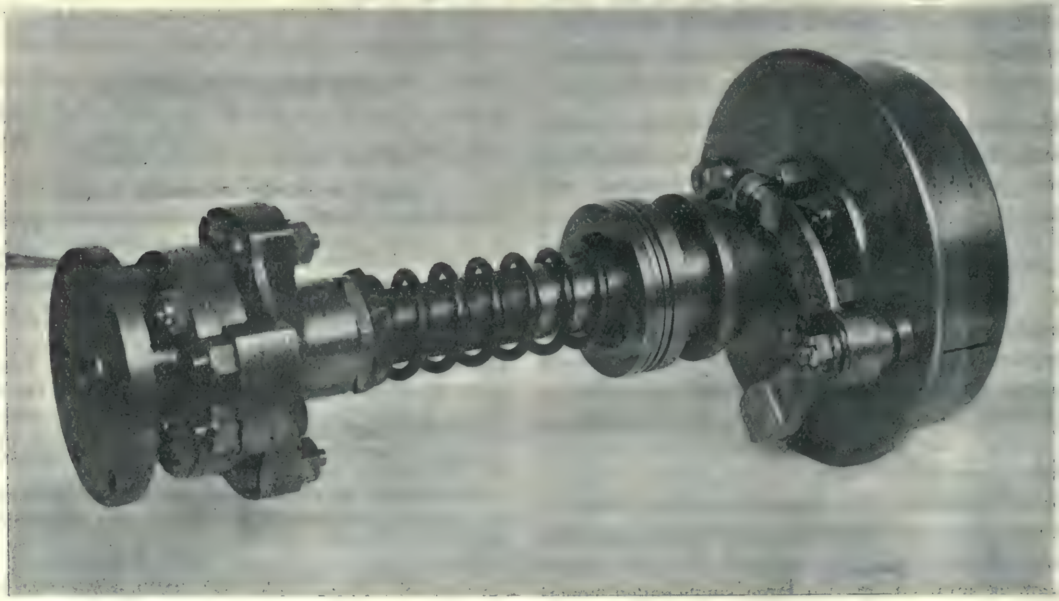


FIG. 1. BROOKE CLUTCH AND FLEXIBLE JOINT.

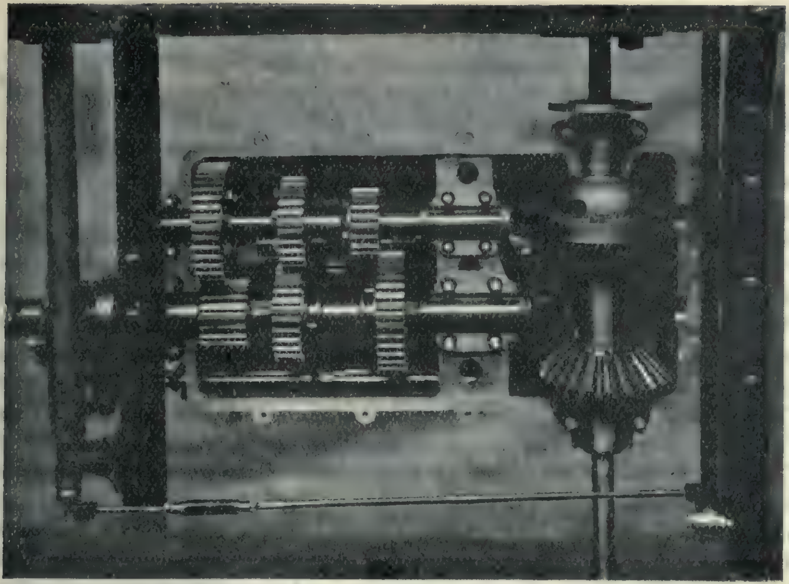


FIG. 2. BROOKE GEAR BOX.

The frame is of pressed steel, tapering at each end to carry the dumb irons, and long and flexible springs are noticeable, which is held to give the car, in conjunction with its wide gauge of 4 ft. 6 in., very easy running.

THE "FODEN" STEAM WAGON.

There are some points of interest in the general design of this steam wagon. The boiler, which is of the horizontal multitubular type, forms the front part of the frame work. The sides of the frame are constructed of strong channel steel, tied and braced together in such a manner as to secure great strength in the complete lorrey. The platform of the vehicle is 10 ft. to 11 ft. long by 6 ft. 3 in. wide. The boiler is fired with coke, coal or wood, and is claimed to be an easy steam maker in the motor-wagon boiler class. The wagon is driven by a compound steam engine fixed on the top of the boiler, so as to be readily accessible, and to work with "dry" steam. The cylinders are 4⅛ in. and 6½ in. diameter, and are fitted with a patented high-pressure gear, by means of which both cylinders can, in case of emergency, receive live steam from the boiler, and each cylinder exhausts independently into the chimney. The reversing motion is of the ordinary link type, and the whole construction of engine and steering arrangement similar to the "Foden" traction engines, so that any ordinary traction engine driver can easily handle the wagon. The power is transmitted by a pair of spur wheels acting on a compensating gear by an extra strong roller chain. The gearing is arranged for two speeds—9 to 1 and 24 to 1. The car is mounted on laminated springs, with steel axle guards containing the sliding axle boxes, similar to those on the modern railway carriage. It is said to be capable of taking a load of five tons on itself and two tons on a trailer at an average speed of six miles per hour, and can travel 20 miles without taking up water. It is designed to climb a hill (with slow speed) of 1 in 6 with full load. The travelling wheels are extra large, front wheels 3 ft. by 5 in. on face, back wheels 4 ft. diameter by 10 in. on face, and so constructed that frost pins and paddles can be used. The back wheels can be made up to 14 in. on face and the front wheels 6 in. for soft roads.

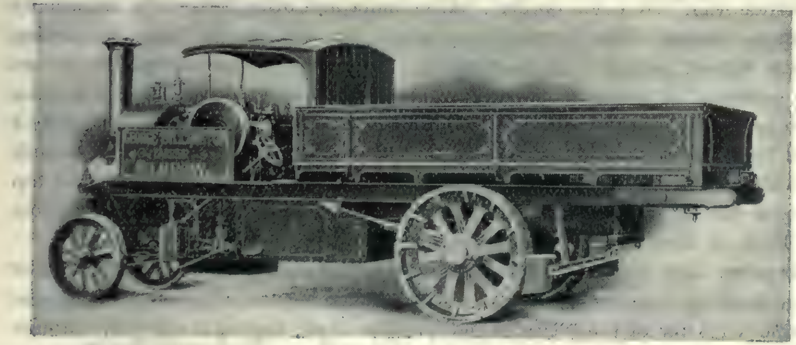


FIG. 3. "FODEN" WAGON DESIGNED TO CARRY 5 TONS AND DRAW 2 TONS.

HINTS ON LUBRICANTS.

IN the lubrication of wearing surfaces of valves and cylinders of steam engines, the engineer meets with conditions altogether different from those encountered in the lubrication of bearings and journals. In the latter case, the working and comparing of one oil with another, and the results obtained, can be easily determined by noting the differences of temperature, etc., but in cylinder lubrication the conditions are altogether different. While in the case of engine bearings and journals the oil can be applied directly to the spot which is to be lubricated, in cylinder lubrication the flow of steam must be depended upon to convey the oil to the parts or rubbing surfaces requiring lubrication. Better lubrication can be obtained with a moderate amount of good oil than with a large amount of unsuitable oil, and better lubrication with just enough than too much oil. The points that govern the quantity of oil necessary for the perfect lubrication of steam cylinders are the conditions of the surfaces, the steam pressure, the amount of moisture in the steam, make, or type of the engine, etc.

An automatic cut-off engine with piston valves or balanced valves requires less oil than an engine with a heavy unbalanced valve. A large cylinder whose position is supported by a tailrod is more easily lubricated than a cylinder whose piston drags on the bottom of the cylinder. Engines which draw their steam supply from foaming or priming boilers, or through long uncovered steampipes, require more oil than an engine supplied with dry steam; and sometimes a cylinder oil that will give good results in contact with dry steam will not do at all with wet steam, no matter what quantity of oil is used.

In the early days of the steam engine the subject of cylinder lubrication was a question that did not give the average engineer very much concern. The lubricant most commonly used was tallow, and the appliances for feeding it generally consisted of tallow cups screwed into the top of the steamchests or to the steampipes, and the engineer would " give her a dose " of melted tallow every once in a while. While steam pressures were low and piston speeds did not exceed 300 ft. or 400 ft. per minute, this kind of lubrication answered fairly well, but as pressures and piston speeds both increased, it was found that the question of lubrication and lubricants became a matter of the greatest importance in the successful operation of steam engines.

Messrs. Matthew Wells and Co., of Manchester, who have specialised on lubricating oils for many years, in a pamphlet just published, lay down the following properties as being absolutely essential. The lubricant should have (1) enough body to keep the surfaces from coming into contact under the maximum pressure; (2) as much fluidity as is consistent with the above requirements; (3) a great capacity for storing and carrying away heat; in other words, the property of keeping a bearing cool with a retention of viscosity; (4) a high temperature of evaporation, and a low solidification temperature; (5) freedom from tendency to decompose or oxidise by exposure to the air, and freedom from gumming or clogging; (6) freedom from acidity and from any tendency to corrode the metal of the bearings to which the oil is applied.

In lubricating oils, viscosity or body is a very important property, especially in cylinder oils. By viscosity is generally understood the degree of fluidity they possess, or the resistance opposed by their smallest particles to their separation. The viscosity of oils is not proportioned to their specific gravity, but to their cohesiveness or internal friction, and oils of the same specific gravity may have entirely different degrees of viscosity.

The apparent body or viscosity of a cylinder oil at ordinary temperature is very misleading. Oils of great viscosity at ordinary temperatures are often very limpid when heated, and a viscosimeter should generally be used for testing. The form of instrument most commonly used consists of a tube or vessel containing a given quantity of oil and surrounded by an outer chamber or jacket containing water, and so arranged that the water can be heated by a steam coil or a flame. The viscosity of engine, machine, and other free-flowing oils is generally tested at about 60 deg., but cylinder and other heavy oils are usually tested at or about 210 deg., or just below the boiling point of water. When the oil has reached the desired temperature, the valve or stopcock at the bottom of the oil chamber is opened, and at the same time a stop-watch is started, and the number of seconds required for it to flow out from a mark near the top of the chamber to another mark near the bottom determines the viscosity.

The engineer who is studying the question of cylinder lubrication should experiment for himself with different grades and qualities of oil, feeding it carefully through a sight-feed lubricator, and gradually reducing the quantity until he reaches and notes the minimum amount required for efficient working.

INSTITUTION OF NAVAL ARCHITECTS.

THE RUSSIAN VOLUNTEER FLEET.

(Continued from page 795.)

Each ton of cargo carried on the round voyage in the *Smolensk* requires 1·104 ons of fuel for its transport, as against 1·624 in a similar vessel with Belleville boilers and ordinary machinery; ·462 tons in the slower vessels and 1·045 tons in the fast vessels with cylindrical boilers. It is, perhaps, hardly necessary to point out that as in trading only half the working parts of the six-cylinder machinery are in use, its life would be prolonged. The weight of the six-cylinder arrangement is practically the same as that of the three-cylinder arrangement, and owing to the valves being arranged on the face of the cylinders the length of the machinery space required is only about two frame spaces more than in the case of a ship with the three-cylinder arrangement; the relative lengths being 42 ft. 9 in. and 38 ft. 9 in.

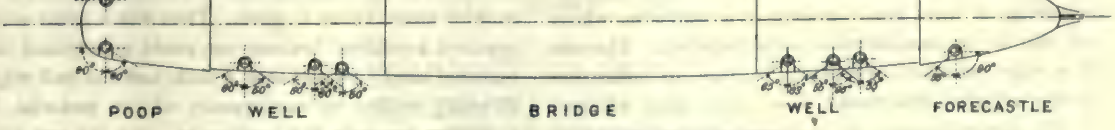
STRENGTH OF SHIPS.

Professor J. H. Biles contributed a paper on "The Strength of Ships, with special reference to experiments and calculations made upon H.M.S. *Wolf.*" He said that the committee on torpedo-boat destroyers, appointed by the Admiralty, made investigations in connection with the strength of these vessels, which led to a review, on the part of the members, of the theory of the relation of stress and strain, and a determination of the amount of stress that came upon a ship at sea. It is generally admitted that the maximum stresses were those which were due to the longitudinal bending of the ship, and that the relation of stress and strain under a given bending moment was based upon a generally accepted theory. The ordinary longitudinal strength calculations afforded a means of comparing the strengths of the various types in certain assumed conditions. A ship experienced the most severe stresses when she was pitching and, heaving among large waves, but in ordinary strength calculations the question of pitching and heaving was not considered, and only the statical effect of the change of distribution of buoyancy due to the wave formation was determined. The results of the deduced stresses obtained during the experiments were very reliable for a large number of positions. In the hogging series the experiment for each position was only conducted once, but in the sagging series the experiments were repeated several times with the indicators in the same positions, so that it was possible to compare the curves obtained during different experiments under exactly the same conditions. In the latter case during different experiments made under the same conditions of bending, the dial readings and consequent deduced stresses were for most of the positions practically the same. This demonstrated that whenever the instruments were fixed in these positions and the vessel was subjected to the same bending moment the same dial readings were recorded. The condition of lading of the boat during experiments was that of fully-equipped sea conditions. The draught of water ranged from 7 ft. 3 in. to 7 ft. even keel. From observations of the indicators under different conditions of weather and steaming it would appear that when the ship was rolling even to such an extent as to submerge the gunwale and a portion of the deck, the stresses set up were very small, the needles in the indicators being scarcely disturbed. In the case of pitching and rolling combined, such as the vessel crossing the seas in an oblique direction, the stresses set up were very much less than those through pitching only, the needles in the instruments moving at the greatest from two to three dial divisions each way, equivalent to a stress of 0·95 tons to 1·45 tons, even in a rough sea.

WHEN MAXIMUM STRESSES ARISE.

The greatest observed effects on the indicators were when the vessel was steaming at fastest speed with head on to wind and sea, her bow lifting and

"SMOLENSK"



SKETCH SHOWING SIZE AND POSITION OF GUNS.

riding on one sea, and then diving in the next advancing one, this latter striking her to such an extent as to cause quite a perceptible tremor to pass through her; the main portion of the hull being then in the trough of the sea, and the vessel being subjected to sagging stresses. Whilst steaming slowly through the sea the period of time in passing from maximum tension to maximum compression varied from 10 to 14 seconds. Whilst steaming at fastest, head to wind and sea, it was rather difficult to observe, but from best observations it appeared to be about from 6 to 8 seconds. The greatest recorded stresses were due to sagging, and were as follows: Keel, 5·38 tension; deck, port, 2·88 compression; deck, starboard, 2·14 compression. When the vessel was in a regular series of waves of standard size the passage of the waves along the length of the vessel caused a variation in the stresses, due to the position of the crest of the wave. From calculations made it had been determined that the maximum theoretical stresses which came upon the *Wolf* in the vicinity of the after boiler-room when on a standard wave, were: Keel, 7·14; deck, port, 5·30; deck, starboard, 5·30. Hence the stresses actually experienced after prolonged seeking for high seas were much less than those obtained under standard conditions. The vessel successfully stood in dock stresses much higher than those found at sea. Stress curves are shown on page 869, and the strain indicators and methods of attachment on page 870.

A STARTING POINT FOR FUTURE INVESTIGATION.

Admiral Fitzgerald testified to the industry and resource and zeal with which Professor Biles carried out the experiments. It had been decided by the Admiralty that the report of the committee was not to be published, and the paper was, for that reason, the more valuable.

Professor Unwin said the first time the bending moment on the ship was calculated was under the direction of Sir William Fairbairn, after the wreck of the *Royal Charter*, and that calculation showed that the deck of the ship was very weak indeed to resist the stresses upon it. The really interesting point of the paper was the comparison of the calculated deflections and stresses, obtained by a very beautiful application of well-known principles and observations on the actual strains in certain parts of the ship. Until those experiments were made they had no knowledge of what the elasticity in a ship was, which was one of the fundamental facts required. The use of a roller between two plates to give an indication of the relative movement was really first adopted in the determination of the modulus of elasticity in the plates used in building the St. Louis bridge. The worst of the roller method was that if there was any slipping the instrument gave no indication of it, although the error was caused. The substitution of a lozenge-shaped piece of steel for the roller was a very great improvement.

Mr. Stromeyer hoped that the results obtained would be a starting point in future investigations with regard to ship design. Bridge-building started somewhat on the same lines. In the early days of bridge-building the different members of the bridges were cut out and springs placed in position and screwed up until the bridge took the old position, and by that means they were able to measure what the stresses were on the different members. Since then mathematicians had very carefully gone into all those questions, and they now had very complete theories of bridges. By adopting that instrument and having thoroughly tested it as regards ships, the Admiralty had done a great service, not only to warship design but also to merchant shipping. It appeared, from what Professor Biles had mentioned, that certain parts of the structure did not do their duty, and necessarily severe stresses must be thrown upon other parts of the ship. He thought that other strain indicators besides his own might with advantage be used to test a ship, so that it might be strengthened and improved. The difference of reading on either side indicated the amount of buckling of the plate, and it was of very great importance to know where it took place.

OPINIONS OF PRACTICAL SHIPBUILDERS.

Mr. Yarrow said there were one or two practical points connected with the construction of torpedo-boats and destroyers which might be worth remarking. They attached great importance to the uniformity of the elastictiy of the structure. Of course a lightly constructed vessel must bend in the sea, otherwise it would very soon come to grief, and if that bending took place uniformly throughout it would stand a good deal, but if in some parts it was very strong, and in other parts it was not so strong, of course bending took place at the termination of the strengthened part. For example, one often saw those vessels with coal-bunkers running between the bulkheads and the boiler compartment, and terminating suddenly. One could sometimes see the bending taking place, and of course that part of the material became fatigued, and sooner or later might come to grief. That was a point which required attention, because one could understand that material might be put into a hull, and the hull might be really weaker in consequence of the material, by a sudden break in the continuity. He did not think

STRESS CURVES.

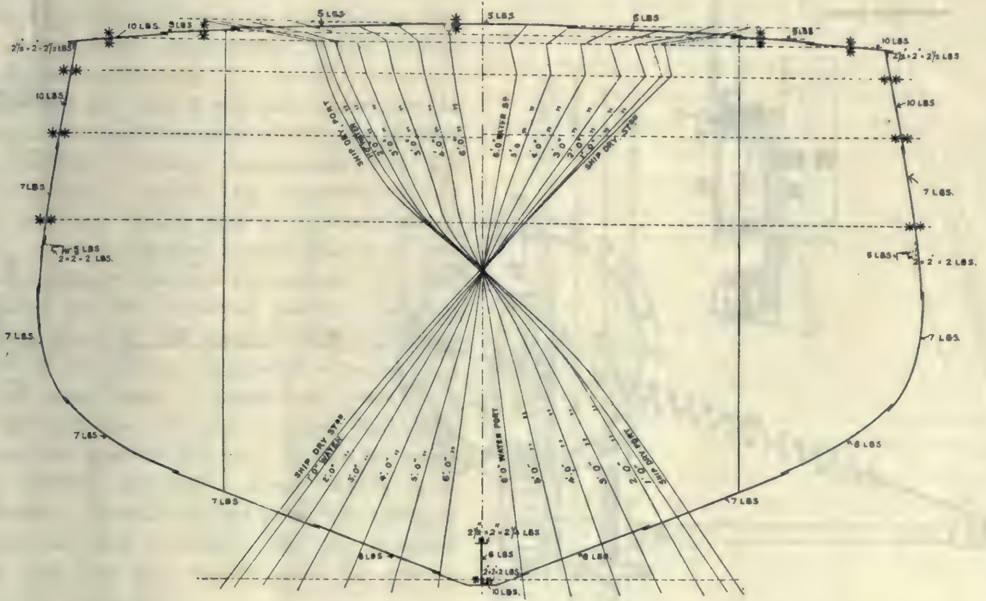
SECTION AT FRAME 84 IN AFTER BOILER ROOM

CURVES SET UP FROM DATA OBTAINED BY STROMEYERS STRAIN INDICATORS

SCALE 1" = 3 FEET.

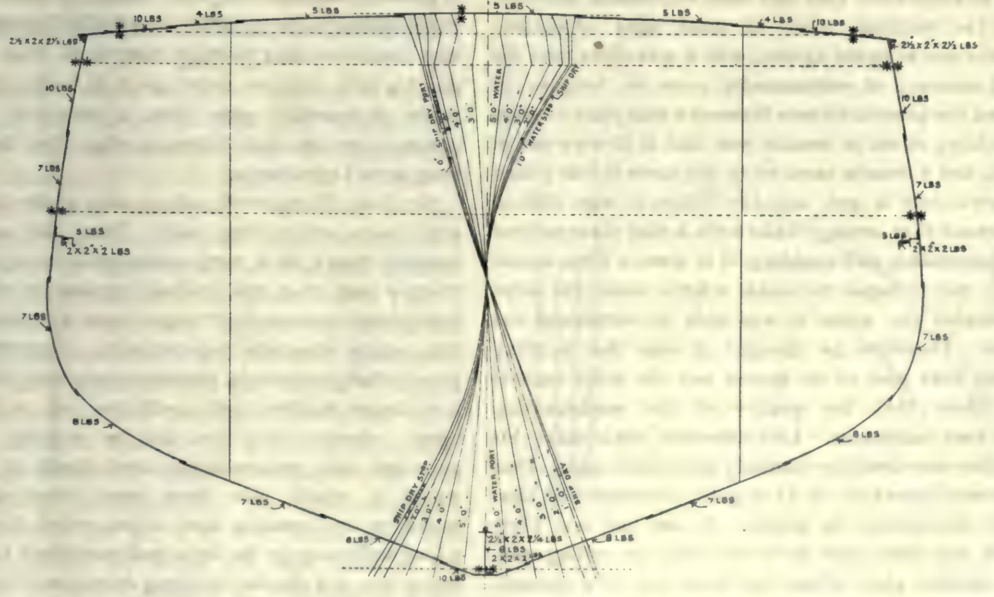
PORT

SAGGING EXPERIMENTS



PORT

HOGGING EXPERIMENTS



REFERENCE

POSITION OF INSTRUMENTS DURING EXPTS INDICATED THUS ⟷

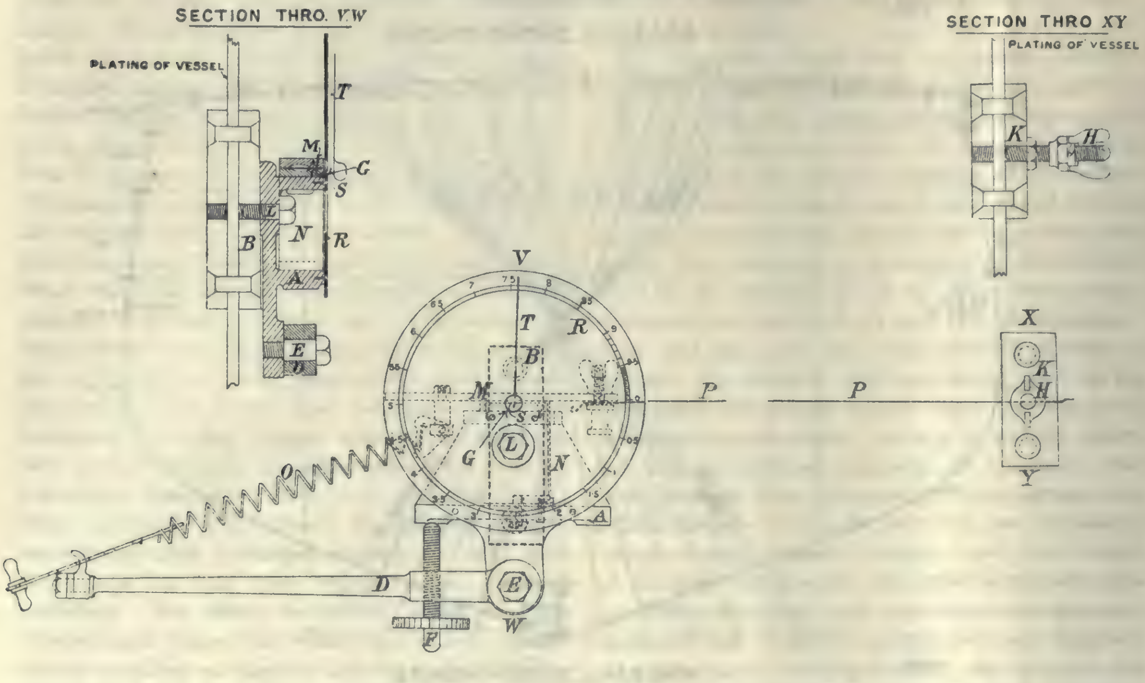
MIDDLE LINE OF SECTION TAKEN AS BASE LINE FOR STRESS CURVES

STRESS CURVES SHOWN IN FULL LINES

SCALE FOR STRESS CURVES 1" = 3 TONS PER SQ INCH

H.M. TORPEDO BOAT DESTROYER "WOLF"

SKETCH SHOWING STROMEYERS STRAIN INDICATOR AND METHOD OF ATTACHMENT TO PLATING OF VESSEL DURING EXPERIMENTS



that in some cases that had been sufficiently attended to. The buckling strain in those light structures was the one to guard against, and it was there that the great accuracy of workmanship came in, because, of course, the great difference between a thin plate bearing a buckling strain or tension was that if it were out of truth, and a tension came on it, the more it was pulled the straighter it got, and the better it was able to withstand that strain; while with a thin plate subject to compression and buckling, if it were a little out of truth, and it began to buckle a little more, the more it buckled the worse it was able to withstand the strain. Therefore he thought it was the buckling strains that had to be looked out for most, and it was there that the quality of the workmanship was very important. In connection with that, his practice was always to hammer the plates cold. That was very important, so as to get a uniformity of elasticity throughout the plates. If one had one plate which was hard, just as it was from the rolling mill, and another plate which had been put in a furnace, he thought the one plate would have to bear a great deal more than its proportion of the strain. That was also a point which ought to be looked at. What they had done was this; they built a boat, and if it showed weakness the next week they had remedied those parts. The gradual growth of torpedo-boats and destroyers had enabled that to be done without any big risk, and one could not help feeling that that mode of operation gave them a very safe working design to go by, just following what they had found from actual experience.

Sir John Thornycroft asked what really happened with boats which they built. They had now been building boats for a very considerable time, and Mr. Yarrow said that the gradual increase in their size had helped them to build larger boats with less danger than might otherwise have existed. Experience had proved that those boats, although apparently very light, had always fulfilled their conditions, and as to transverse strength they had had no trouble. But he admitted that weakness had been found in a point where it would not have been expected. They found on one occasion that a boat which had rather a long hatchway in the deck, and was driven through a heavy sea, was crushed by being driven into the waves; the middle of the hatchway became narrower, so that the boat was not strong enough to stand the pitching. But with regard to strength across, they had never had any indication that the boats had been deficient. They made calculations as to what would be the probable stress, and they always took what they considered a safe margin, and had had no failure.

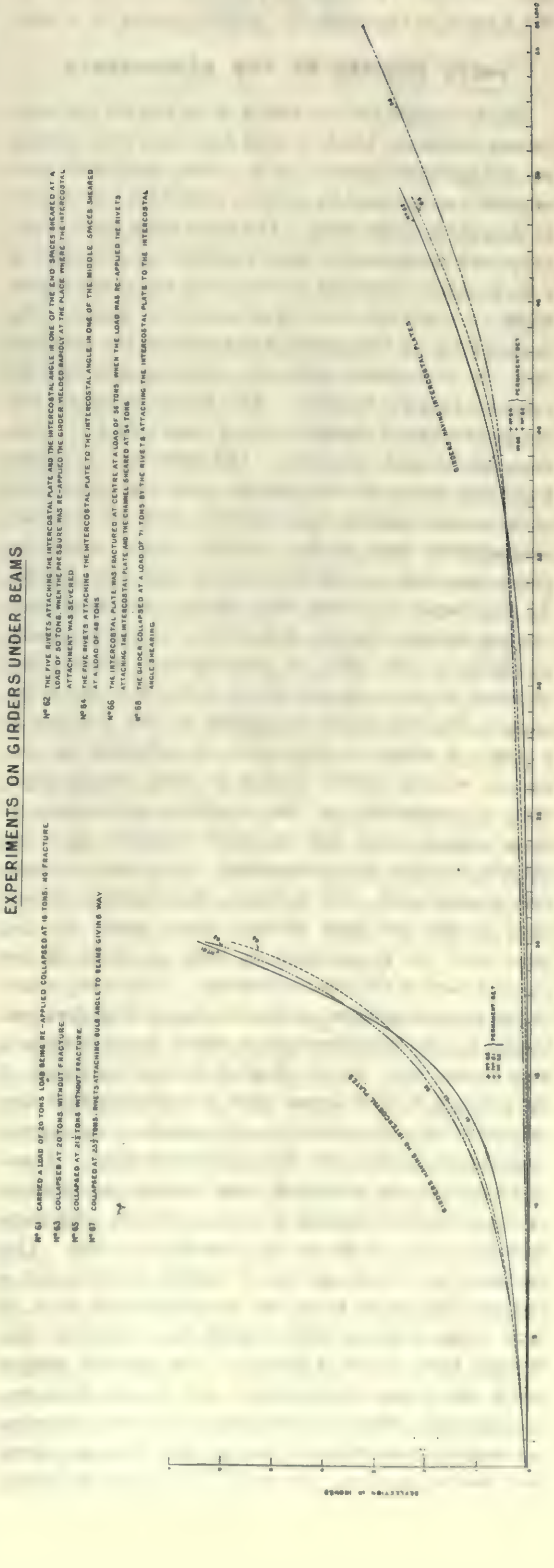
AN IMPORTANT CONTRIBUTION TO NAVAL ARCHITECTURE.

Mr. Foster King thought the paper might be regarded as a most important contribution to the science of practical naval architecture.

Sir William White said it was most important, in considering the comparison made between the stresses calculated on the ordinary assumptions with the stresses ascertained actually by measurement, to remember they were dealing with an extremely simple structure. He was delighted to find that there was so close an agreement between the ordinary standard of calculation and the observed results. But the method was tested in the simplest form—a single-deck ship. If one had a complicated structure like a ship with many decks, it would vary very much from that simple case. It was fortunate that comparison had been made in that way, because the result was most valuable and had a direct bearing upon future practice. All who had had to do with strength calculations had been convinced that the standard ordinarily used must give results above the stresses which occurred in practice.

STRUCTURAL ARRANGEMENTS IN SHIPS.

Dr. Bruhn, surveyor to Lloyd's Register, in a paper on "Some Experiments on Structural Arrangements in Ships," said that experiments had been undertaken by the Committee of Lloyd's Register with a view to obtaining reliable information concerning various methods of construction or forms of girders which had from time to time been proposed to be adopted in ships, and had been submitted to the Committee of Lloyd's Register for their approval. Some of the information gained by the experiments was previously established by calculation, and where that was the case the results of the one method only confirmed those of the other. In some instances, however, the experimental information obtained could not readily have been derived from purely abstract investigations. The experiments were planned by the late Mr. T. C. Read, some years ago, and were carried out under the supervision of the surveyors to Lloyd's Register at Newcastle-on-Tyne. The aim of the series was to determine the relative stiffness of the various forms of framing, viz., plain angles, angles with reversed frames, deep frame girders, channel bars, bulb angles, and zed bars. The series was divided into two parallel sub-divisions; one



EXPERIMENTS ON GIRDERS UNDER BEAMS

Nº 61 CARRIED A LOAD OF 20 TONS LOAD BEING RE-APPLIED COLLAPSED AT 16 TONS. NO FRACTURE

Nº 63 COLLAPSED AT 20 TONS WITHOUT FRACTURE

Nº 65 COLLAPSED AT 21½ TONS WITHOUT FRACTURE

Nº 67 COLLAPSED AT 25½ TONS. RIVETS ATTACHING BULB ANGLE TO BEAMS GIVING WAY

Nº 62 THE FIVE RIVETS ATTACHING THE INTERCOSTAL PLATE AND THE INTERCOSTAL ANGLE IN ONE OF THE END SPACES SHEARED AT A LOAD OF 50 TONS. WHEN THE PRESSURE WAS RE-APPLIED THE GIRDER YIELDED RAPIDLY AT THE PLACE WHERE THE INTERCOSTAL ATTACHMENT WAS SEVERED

Nº 64 THE FIVE RIVETS ATTACHING THE INTERCOSTAL PLATE TO THE INTERCOSTAL ANGLE IN ONE OF THE MIDDLE SPACES SHEARED AT A LOAD OF 48 TONS

Nº 66 THE INTERCOSTAL PLATE WAS FRACTURED AT CENTRE AT A LOAD OF 56 TONS WHEN THE LOAD WAS RE-APPLIED THE RIVETS ATTACHING THE INTERCOSTAL PLATE AND THE CHANNEL SHEARED AT 54 TONS

Nº 68 THE GIRDER COLLAPSED AT A LOAD OF 71 TONS BY THE RIVETS ATTACHING THE INTERCOSTAL PLATE TO THE INTERCOSTAL ANGLE SHEARING where only the frame girder itself was tested, and another where a plate 12 in. in width was riveted to the frames to represent the outside plating of a ship.

FACTS ELICITED BY THE EXPERIMENTS.

All the sample girders were 9 ft. in length, and were resting freely on blocks 1 foot fom each end, leaving an unsupported span of 7 ft. The specimens were subjected to bending by weights placed on a scale pan at the centre of the span. The deflections, both vertically and horizontally, were recorded in a length of 7 ft. for each increment of load, and any other movement in the structure was carefully noted. The material for all the girders was tested in the ordinary way, in accordance with the requirements of the rules of Lloyd's register. The tensile strength and the percentage of elongation in a length of 8 in. were recorded for each specimen. The chief facts obtained from the series of experiments were the deflections of the various girders in a length of 7 ft. for a known concentrated load applied at the centre, while the girder was free to deflect vertically and horizontally. As the frames of a ship were always prevented from bending sideways by the shell plating, it was necessary to eliminate the effect of such actions, where they occurred in the experiments, in order that the information obtained could be applied to the framing of a ship. A glance at the curves of deflection for the girders without plates riveted to them would show that a comparison of the resultant deflections of these girders when free to move laterally must be entirely different to a comparison, when lateral deflection is prevented. For instance, the resultant deflections of the zed bars without plates were, for the same load, 2½ to 3½ times as large as those of the channel bars of the same scantlings. This comparison of the relative stiffness of the two types of girders was correct for the conditions under which the experiments were carried out; but it afforded no direct criterion of the stiffness of these forms when lateral deflection was prevented, as was evidenced by the results of the experiments on the girders with plates riveted to them. These plates practically prevented side bending, in addition to their otherwise making the experimental conditions more like those of the actual framing of a ship. The tendency for certain girders to deflect sideways for a vertical load arose from the unsymmetrical form of their cross sections with regard to a vertical line through their centre of gravity. The channel section was in this respect symmetrical, and the zed form unsymmetrical. Hence the very large difference between the resultant deflections of these girders when no plates were riveted to them. In order to eliminate the effect of side bending, where such was found, and thus to obtain a fair comparison for symmetrical and unsymmetrical sections alike, as they were used in practice, it was necessary to employ the formulæ for oblique bending. There would always be some points of difference between the specimens tested and the parts in the ship they were supposed to represent.

DIRECT APPLICATION OF RESULTS DIFFICULT.

There would, therefore, always be difficulties in the way of an absolutely direct application of the results of the experiments. In bridging these hindrances, and making the results applicable to actual ships, resort must be had to more or less abstract methods. It was desirable that the arrangements, both in the general design and in the details of the sample structures, as well as the general experimental conditions, should as nearly as possible correspond to those of the counterparts and to the circumstances in the actual ship, with a view to obtaining more reliable information and minimising, as far as practicable, the difficulties in the way of a direct application of the results obtained. In designing the sample structures it was also important to see that the point under consideration was brought out, and other questions eliminated as far as possible. The experimental girders ought, therefore, in such cases to be comparatively short and deep. In general, it was not possible simply to construct a portion of a vessel and then test it. If that were done some information would be gained with regard to the part where the structure yielded, but the chances were that it would not have any bearing on the point it was desired to investigate.

Professor Biles was sorry that no one from the large shipbuilding firms was present to open the discussion, especially those firms who for a good many years had believed in not putting intercostals between the beams. Personally he never could see the utility of fitting keelsons on the top of floors or on the under-side of beams which were not connected with the shell-plating or the deck-plate. It appeared to him that the material was unable to take its share in the stresses which were brought upon the shell-plating or the deck-plate. He much regretted that the experiments were not carried out with Stromeyer's strain indicator. If they had been, they would have known exactly what happened when the thing actually broke down, and what was the relation between stress and strain at every point of application of the load. That was not only of academic interest, but also of intense practical interest, because they did not build ships for parts of them to break down; they built them so that they would be capable of retaining their elasticity, so that they would never be strained beyond the elastic limit, and none of the experiments gave any indication of where the elastic limit of the combination was. One had been disposed in carrying out intercostal work to try to make as good a fit as possible between the frames, partly to prevent tripping and partly to attempt to make use of the intercostal for compression. The latter part, the resistance of compression, he had abandoned. The present competition prevented the proper fitting of intercostals. Their thanks were due to the author and to the Committee of Lloyd's Register for their experiments to clear up debatable points in the structure of ships. He hoped they would give further results of experiments and would associate the results not only with breaking strengths but with the elastic deformation throughout the whole of the experiments.

MOMENT OF RESISTANCE AS A MEASURE OF STRENGTH.

Mr. Foster King said they had had a warning not to accept too literally the general statement that the moment of resistance was a fair measure of the strength of the section. He deduced a somewhat different conclusion from the author with regard to the question of the rivet attachment to the frames; he thought it was a warning to the naval architect to make certain that the depth of the frame girder had a just relationship to the span, otherwise he would not obtain the full value of his frame.

Mr. Thearle said that any experiments which were in future conducted under the auspices of the Committee of Lloyd's Register, which proved to be of a useful character, would be willingly communicated to the Institution. The Committee were disposed to pursue their inquiries still further, and he was hopeful they would be able to intimate soon that the Committee were prepared to conduct their experiments upon the question of the possibility of frame tripping beyond depths of 7 in. He agreed with Professor Biles that it would be desirable to associate Stromeyer's indicator with the remainder of the experiments in order to determine what took place between the time the strain was first applied and the time when rupture took place. A few years ago there was a difficulty in convincing some shipbuilders that the intercostal was of value corresponding with the cost and with the weight. He did not think there was much doubt on that subject now.

Mr. Young thought it would be good to reverse the reversed frame, and make it point in the same direction as the frame, and thus get the channel bar arrangement. There would be difficulties, but more value would be got out of it.

THE MINING INSTITUTE OF SCOTLAND.

The twenty-eight annual meeting of the Mining Institute of Scotland was held on Thursday, the the 13th inst., in Hamilton. Mr. R. T. Moore presided over a large attendance of members. The annual report of the Council was submitted by Mr. James Barrowman, Secretary, and showed the total membership to be 513, as compared with 492 at the close of the preceding year. Financially, too, the Institute is in a sound position, there being a credit balance of £561 3s. 7½d. The report was adopted. The officers for 1905-6 were elected as follows: President, Mr. R. T. Moore; Vice-Presidents, Messrs. James Hamilton, David Morrat, R. McLaren, and Thomas Thomson.

Mr. R. T. Moore, in the course of his presidential address, urged the application of every means, mechanical or otherwise, to render labour efficient at the point of attack in mining operations, and in this connection he mentioned sinking as being one of the operations on which good papers might be written. The most valuable contribution to mining knowledge during the year had, he said, been the report of the Royal Commission. It was of special interest to the Institution because of the association with it of their past president, Mr. James T. Dixon, whose masterly report on the Scottish coalfields summed up all the available information on the subject, and would long be a classical work of reference.

On the motion of Mr. J. T. Forgie, Bothwell, Mr. Moore was cordially thanked for his address. The Institute thereafter resumed consideration of Mr. E. O. Forster Brown's paper on "Notes on the Application of Electrical Power to Mines in Germany." The discussion was ultimately adjourned.

The eighth ordinary meeting of the Institution of Civil Engineers, Yorkshire Students' Association, was held in the Law Institute, Leeds, Mr. S. R. Kay, M. Inst. C.E., in the chair. A paper was read by Mr. J. Dalton Milner, Stud.Inst.C.E., entitled "Some Recent Hull Bridges." The bridges described were the Scott-street, Witham and Stoneferry bridges. The first is a steel structure of the bascule type, in three spans, the centre one being the lifting span, and is operated hydraulically. The Witham bridge is a ferro-concrete structure on the Hennebique system, with concrete abutments supported on piling. The Stoneferry bridge is a swing bridge with a fixed span at the east end. The main girders are of the open webbed N type, with arms of unequal length, decked with Hobson's flooring. The bridge is operated by electrically driven gearing.

THE LABOUR MARKET.

BOARD OF TRADE returns just issued show that on the whole employment improved in March as compared with the preceding month.

Employment in coal mining showed a slight decline as compared with a month and a year ago. In iron mining employment was good, showing little change compared with a month or a year ago.

Employment in the pig iron industry continued to improve during March and was considerably better than a year ago. Returns relating to the works of 108 ironmasters showed that 316 furnaces, employing about 22,500 workpeople, were in blast at the end of March, 1905—an increase of 4 as compared with the previous month, and of 13 as compared with March, 1904. The number of furnaces in blast was greater than in any month since October, 1903.

Districts.	Number of Furnaces, included in the returns, in Blast at end of			Increase (+) or Decrease (−) in March, 1905, as compared with	
	Mar., 1905.	Feb., 1905.	Mar., 1904.	A month ago.	A year ago.
ENGLAND & WALES—					
Cleveland	82	79	76	+ 3	+ 6
Cumberland & Lancs.	34	35	32	− 1	+ 2
S. and S.W. Yorks.	14	13	13	+ 1	+ 1
Derby & Nottingham	36	37	37*	− 1	− 1
Leicester, Lincoln, and Northampton	27	26	25	+ 1	+ 2
Stafford & Worcester	31	31	31	...	.
S. Wales & Monmouth	14	14	13	...	+ 1
Other districts ...	7	7	6	...	+ 1
Returned from England & Wales	245	242	233*	+ 3	+ 12
Returned from Scotland	71	70	70	+ 1	+ 1
Total furnaces included in returns	316	312	303	+ 4	+ 13

Employment at iron and steel works was good and showed little change as compared with a month ago. It was considerably better than a year ago.

Employment in the engineering trades continued to improve somewhat, and was better than a year ago, and in the shipbuilding trades it showed on the whole an improvement as compared with both a month and a year ago.

NOTES AND NEWS.

The amalgamation of two important German electrical companies—viz., the Felten and Guilleaume Company, of Mülheim, and W. Lahmeyer and Co., of Frankfort—was at first discredited as merely a Stock Exchange rumour, but is now confirmed. The combined capital of the two undertakings will represent a sum of about £2,750,000.

The Prime Minister, representing some 300 subscribers, recently made an interesting presentation to Sir William Arrol, in one of the House of Commons Committee Rooms. The presentation marked the fact that on his wedding-day—the 9th of last month—Sir William made a lightning journey from Ayr to Westminster to vote against Mr. Churchill's fiscal amendment to the Address.

The paper on "Metallography" recently read by Mr. Edward L. Buttenshaw, before the Manchester Students' Section of the Institution of Electrical Engineers, was noteworthy for the fact that the author exhibited a large number of slides showing the microscopic structure of metals. Some of these were reproduced in our issue of March 24th, the particular ones selected being the work of Mr. Stead, but the majority of the slides exhibited at Manchester were the combined work of Mr. Edward L. Buttenshaw and his brother.

The tone of the Birmingham quarterly iron meeting held last Thursday was more favourable, the only element of doubt being whether America will take any quantity of supplies from this side. The general opinion is that America will be compelled to do so in view of the record consumption.

The following view of the world's naval powers is presented in a return this week :—

BUILT.

	Great Britain.	France.	Russia.	Germany.	Italy.	United States.	Japan.
Battleships, 1st class	53	20	14	16	14	12	5
,, 2nd ,,	4	9	4	4	—	1	1
,, 3rd ,,	2	1	1	9	2	—	—
Coast Defence Vessels, Armoured	1	13	12	11	—	11	1
Cruisers, Armoured	24	17	5	4	6	8	8
,, Protected, 1st class	21	7	5	1	—	3	—
,, ,, 2nd ,,	45	16	3	8	5	17	11
,, ,, 3rd ,,	21	16	2	16	13	2	7
,, Unprotected	—	1	3	17	1	7	8
Torpedo Vessels	21	15	7	1	11	—	1
Torpedo boat Destroyers	128	31	40	87	13	20	21
Torpedo-boats	91	238	162	84	128	31	84
Submarines	17	37	13	1	1	8	—

BUILDING.

	Great Britain.	France.	Russia.	Germany.	Italy.	United States.	Japan.
Battleships, 1st class	8 1*	6	5 3*	6 2*	4	12 1*	2
Cruisers, Armoured	15 4*	6 2*	2 4*	3 1*	1 3*	7 2*	—
,, Protected, 1st class	—	—	2	—	—	—	—
,, ,, 2nd ,,	1	—	—	—	—	—	—
,, ,, 3rd ,,	—	—	—	4 3*	—	—	—
Scouts	8	—	—	—	—	3*	—
Torpedo-boat Destroyers	16 18*	8 4*	55 8*	6 6*	4*	—	—
Torpedo-boats	—	26 70*	10	—	27	1	—
Submarines	12 11*	9 23*	12 2*	1	5 2*	4*	—

* To be laid down 1905-19 6.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Eastham, (Cheshire). — The Rural District Council of Wirral invite tenders for the construction of sewers and sewage purification works at Childer Thornton, Eastham, and Hooton, and at Eastham Village. Mr. F. E. Priest, 13, Harrington Street, Liverpool, engineer ... ... April 22

Colchester.—Supply, delivery, erection, fixing, laying, jointing, setting to work, and maintaining for a given period, a triple-expansion horizontal pumping engine of the Worthington type, a multitubular steel boiler, traveller, cast-iron pumping and suction mains, with connections to existing mains, for the Corporation. Mr. G. E. Bland, Waterworks Superintendent, Town Hall, Colchester ... ... April 24

Stockport.—Supply of one 500-k w. steam generator for the Gas and Electricity Committee. Mr. A. J. H. Carter, Electricity Works, Millgate, Stockport ... April 26

Croydon.—Deep-well pumping engine and boilers for the Stroud Green well, Woodside, Croydon, for the Croydon Town Council. Mr. Geo. F. Carter, A.M.I.C.E., borough engineer, Town Hall, Croydon... April 26

Manchester. — Construction of a new curve and the widening of a portion of their main line at Throstle Nest, Manchester, for the Cheshire Lines Committee. Mr. Harry Blundell, engineer to Cheshire Lines Committee, Central Station Liverpool ... ... April 27

Wimbledon.—Supply and erection of the following plant in connection with electricity works for the Wimbledon Urban District Council: a 1,000-kw. steam-driven turbo-alternator, with condensing plant, high-tension switchgear, and pipework. Mr. H. Tomlinson-Lee, Electricity Works, Durnsford Road, Wimbledon ... ... April 28

Bristol.—Construction, delivery, erecting in place, fitting, testing, and maintenance for twelve months after completion, of two electric goods lifts and one electric passenger lift, to be erected in the tobacco warehouse now in course of construction near Cumberland Basin, Bristol, for the Dock Committee. Mr. N. W. Squire, Engineer, Cumberland Basin, Bristol ... May 1

Last Day.

Bournemouth.—The Town Council invite tenders for the following: (Contract No. 5) Feeder cables, troughing, excavation, &c. Mr. F. W. Lacey, M.I.C.E., Municipal Offices, Bournemouth ... ... April 29

Coalville. — The Urban District Council (Gas Department) invite tenders for the supply of a steel gasholder and tank and its erection at the Gas Office, Whitwick. Mr. Jos. W. Eagles, Gas Office, Whitwick. May 1

Shrewsbury.—Tenders for taking down the old cast-iron bridge at Buildwas, and for the supply and erection in its place of a steel curved girder bridge. Mr. A. T. Davis, M.Inst.C.E., County Surveyor, Shirehall, Shrewsbury ... ... May 3

Bishop's Stortford.—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... May 8

Manchester.—Supply of oil for the manufacture of carburetted water gas for the Gas Committee. The oil to have a flashing point of not less than 73 degrees. Mr. Charles Nickson, Superintendent of the Gas Department ... ... May 10

Barrow-in-Furness.—Construction of a steel road bridge over the Walney Channel, uniting Barrow Island and Walney Island. The bridge will be about 1,123 ft. in total length between abutments and 50 ft. in length, and will consist of eight fixed girder-spans, and one opening span, on cylinder foundations. Sir Benjamin Baker, K.C.B., 2, Queen Square Place, Queen Anne's Mansions, Westminster ... ... May 15

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

COMING CONTRACTS.

Warwick.—The new scheme for augmenting the water supply at Warwick involves the construction of a reservoir to hold 500,000 gallons, the sinking of a well, the erection of an engine-house, and the laying down of pumping machinery. Messrs. Wilcox and Raikes are the engineers.

Ashbourne.—The L.G.B. has sanctioned a loan for the construction of the Kirk Ireton waterworks for the Ashbourne Rural District Council as designed by Mr. Harry W. Taylor, A.M.I.C.E., of Newcastle-on-Tyne and Birmingham. Tenders are to be invited at once.

Durham.—A Local Government inquiry has been held into the application of the Durham Town Council for permission to borrow £16,589 in connection with the new sewage disposal scheme.

Leyton.—An inquiry has been held into the application of the Urban District Council for sanction to borrow £5,000 for electric supply purposes.

Hackney.—The London County Council has agreed to lend the Hackney Borough Council the sum of £11,083 for electric supply and street lighting extensions.

Reigate.—It was decided by the Town Council, at its last meeting, to apply for sanction to borrow £4,000 for electric supply extensions.

Portsmouth.—The Board of Trade have confirmed the Portsmouth and Hayling Island Light Railway Order, 1905, authorising the construction of a light railway in Portsmouth and Havant.

Motherwell.—Extensions of the electric lighting plant and mains, estimated to cost £6,500, have been authorised. Application has been made for sanction to borrow £20,000 to cover this amount and to meet the cost of further extensions.

CONTRACTS CLOSED.

Great Central Railway.—In order to still more satisfactorily cope with their increasing fish traffic from Grimsby, the Great Central Railway are shortly to make additions to their rolling stock, and as a preliminary have just placed an initial order for 50 "high capacity" fish vans with R. V. Pickering and Co., Ltd.

Mersey Docks.—In addition to the contract for the large double-storey shed, about 500 ft. long by 80 ft. wide, at Sandon Dock, which Messrs. Francis Morton and Co., Ltd., have in hand for the Mersey Docks and Harbour Board, they have now secured the contract for a further single-storey shed at King's Dock No. 1, about 941 ft. long by 120 ft. wide.

Southend.—The Hart Accumulator Company informs us that the Corporation of Southend-on-Sea have placed with it the order for renewing the battery at their electricity works, London-road, with 132 of the company's standard lighting type cells.

Plymouth. — Raworth's Traction Patents, Ltd., have received an order from the Corporation of Plymouth for six new cars, with regenerative control, for use on the new route to Pennycomequick; and the Scarborough Tramways Company, after six months' experience with three cars, have decided to proceed with four more cars, also to be fitted with regenerative control.

Poplar.—The Urban District Council of Poplar, London, has ordered from the Stirling Boiler Company one of its marine type boilers.

Leeds.—M'Alpine and Co., of Glasgow, have obtained the contract from Leeds Corporation to construct the Colsterdal water reservoir, the amount of the tender being £297,000.

APPOINTMENTS VACANT.

Last Day

Mexico.—Messrs. Preece and Cardew invite applications for the appointment of chief engineer to an electricity supply undertaking in Mexico City. Experience with three-phase working is essential. Applications to Messrs. Preece and Cardew, 8, Queen Anne's-gate, Westminster, S.W. April 22

London.—A draughtsman is required to assist in the design of a new engineering laboratory. Salary £3 per week. Applications to Prof. Coker, City and Guilds Technical College, Leonard-street, Finsbury, London, E.C.

London. — Two additional assistants are wanted in the department of electrical engineering of the City and Guilds Central Technical College, Exhibition-road, London, S.W. Salary £150 per annum. Applications to Prof. Ayrton.

Hull.—A lecturer on electrical engineering is required at the Hull Municipal Technical School. Commencing salary £160. Applications to the Director of Studies Dr. J. T. Riley ... ... May 4

Northern India. — Applications are invited for the first European Professorship (Physics) at Meerut College, Northern India. Salary, £320 per annum (£50 passage money). Particulars from Prof. Worthington, Mohuns, Tavistock.

APPOINTMENTS FILLED.

London.—Mr. Frank Sumner has been appointed engineer to the Corporation of the City of London. Mr. Sumner started as surveyor's assistant to the Willesden D.C. in 1889. In 1892 he was appointed the chief surveyor to the Bermondsey Vestry, where he remained until 1899. In 1899 he became successively surveyor to Plumstead Vestry and the Borough Council of Woolwich.

Newport.—Mr. A. G. Dovey, of the engineer's department of the Newport Corporation, is recommended for appointment as deputy borough engineer of Newport, in the place of Mr. S. L. F. Fox, who has been appointed borough engineer of Luton.

Brighton.—Mr. A. Wright has been engaged as consulting electrical engineer to the Brighton Corporation for a period of six years, at a salary of £600 a year. In the event of the profit on the electrical undertaking exceeding during that time £5,000, after payment of all debt charges, interest and working expenses, a commission equal to 5 per cent. on the profit will be paid to him.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—

Consols : May 4th, June 1st. General Settlements : April 28th, May 12th. Bank Rate, March 9th, 1905, 2½ per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¾— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅝— 4⅞
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	$3\frac{5}{16}$—$3\frac{7}{16}$
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5½— 5¾
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4⅘	Babcock and Wilcox, Ltd., Ord. ..	1	4⅞ —5⅛
100,000	1	7⅕d.	Do. ,, 6% Cum. Pref.	1	$1\frac{7}{16}$—$1\frac{9}{16}$*
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾— 5¼
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —105
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	$1\frac{3}{16}$— $1\frac{5}{16}$
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛— 4⅜*
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104 —106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾— 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	$\frac{7}{16}$— $\frac{9}{16}$
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	¾ — ⅞
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	$\frac{15}{16}$—1
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	½— $\frac{9}{16}$
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	$1\frac{3}{16}$— $1\frac{5}{16}$
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	$1\frac{25}{32}$— $1\frac{27}{32}$
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11¼— 11¾
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8¾— 9
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅛ — 5¼
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	$1\frac{1}{32}$—$1\frac{3}{32}$
70,000	5	2/6	Do. 5% Cum. Pref.	5	5½— 5¾
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 —103
100,000	10	7/6	Consett Iron Co., Ltd., Ord.. ..	7½	32— 33
57 031	10	10/-	Crossley, Bros., Ld, Ord. 40340/97370	10	16 —16¼
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—12
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	⅝— $\frac{11}{16}$
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3⅜— 3⅝
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord...	1	½— ⅝
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	⅞ - $\frac{15}{16}$
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½— 10½
69,754	13	12/-	Do. do. do.	10	7¾— 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½— 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾— 9¼
186,748	Stk	4%	Do. Deb. 4%	100	94½— 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng.Co., Ltd., 6% Cum. Pref. ..	10	10¾— 11¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000..	10	12 —12¼*
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4⅝— 4⅞
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾— 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	90½—91½
16,800	10	—	Greenwood & Batley, Ltd., Ord. ..	10	4¼— 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¼— 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2¼ — 2⅜
344,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6¼
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb.Stk	100	106 —108
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅛— 3¼
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾— 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1¼ — 1⅜
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10¾— 11
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5 — 5½
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	$\frac{11}{16}$— $\frac{13}{16}$
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾— 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½— 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1⅝— 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	18½— 19½
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾— 11
300,000	1	4⅘d.	Lambert Bros., Ltd., Ord.	1	⅝— ⅞*
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4¼— 4¾
40,000	3	2/1⅕	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾— 4¼
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	$1\frac{5}{16}$— $1\frac{7}{16}$
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	109 —111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11¾
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	⅝— ¾
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	$\frac{13}{16}$— $\frac{15}{16}$
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	5¼— 5½
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5⅛*
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	77 — 80
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 —12¼
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞— 4⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5⅞— 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9¾— 10¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	99 —102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	$4\frac{15}{16}$ $5\frac{3}{16}$
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/- — 6/
13,000	5	—	Do. 5½% Cum. Pref.	5	4⅜— 4½
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜— ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅞— 2
73,062	5	2/-	Do. New	5	1½— 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	101 —103
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅞— $\frac{15}{16}$
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9½— 10
275.000	1	6d.	Scott (Walter), Ltd., Ord.	1	¾— ⅞
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	$\frac{15}{16}$ — $1\frac{1}{16}$
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	92 — 95
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	$\frac{21}{32}$— $\frac{23}{32}$
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	$\frac{27}{32}$ — $\frac{29}{32}$
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 — 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5¼— 5⅝
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb. ..	100	106½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 — 2¼
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4¼— 4¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	78— 81
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17½— 18*
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½— 15*
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾— ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort.Deb.Stk.Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum.Pf.	1	⅝ — ¾*
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	74 — 79*
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	$\frac{13}{16}$— $1\frac{1}{16}$
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½— 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	38 — 38¼
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	106⅛—106⅜
$162268000	$1000	5%	Do. 10-60yr. 5% Skg.Fd.G.Bds.	$1000	98 —100*
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord..	1	2⅜— 2½
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	$1\frac{3}{16}$ —$1\frac{5}{16}$
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	117 —120
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	107 —109
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	¾— ⅞
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	84 — 88
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜— 4⅞
800	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	$\frac{7}{16}$— $\frac{9}{16}$
120,000	1	1/2⅖	Bell's Asbestos Co., Ltd.	1	$\frac{13}{16}$— $\frac{15}{16}$
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99 —101
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅞— 3⅛
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	91 — 93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4⅘	Do. 6% Pref.	2	1½— 2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 11½
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5½— 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107 —109
85,000	3	1/6	Crompton & Co., Ltd...	3	2 — 2¼
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	93— 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7½— 8
161,000	5	3/-	Do. 6% Cum. Pref.	5	5¾— 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1 — 1¼
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1¾— 2¼
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	80 — 85
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	84— 89
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛— 1¼
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	2¼— 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd..	10	11 — 15*
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5⅜— 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 38
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜— 8⅝*
260,007	5	2/6	Do. 5% Cum Pf.	5	5¾— 6
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 -- 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	$\frac{13}{16}$— $\frac{15}{16}$
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	$\frac{15}{16}$— 1$\frac{1}{16}$
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	104 —107
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼— 9¾
156,437	10	6/-	Do. 6% Cum. Pref... ..	10	10¾— 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	120 --122
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½— 3¾*
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½— 5¾*
27,000	5	3/-	Do. "B" do.	5	5¼— 5½*

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97 -- 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 –105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8¼— 8½*
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜— 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4¾— 5*
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102*
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103 —105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½— 14½
59,987	10	6/-	Do. 6% Pref...	10	15½— 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½— 3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	85 — 90
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10¼—10¾
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 —102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	$\frac{13}{32}$—$\frac{15}{32}$
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1$\frac{1}{16}$
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2⅖	North Metropolitan Tramways Co..	8	4 — 4½
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9 — 9½
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9½— 10
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103 —107

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾— 12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾— 10¼
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5⅛— 5⅝*
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9½— 10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9½— 10½
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	7½— 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅜— 5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½— 7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½— 12
40,000	10	6/-	Do. 6% Cum. Pref... ..	10	13½— 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾— 6
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅛— 6⅜
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	3/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5¾*
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½— 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7½— 8*
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	101—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	$\frac{11}{16}$— $\frac{13}{16}$
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12½— 13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	5	1/9⅗	London Elec. Supply Corp., Ld., Ord.	3	2¼ — 2¾
60,000	5	3/-	Do. 6% Pref.	5	5¼ — 5¾
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	17½—18½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅝ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99 —101
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —103
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref.	5	8¼— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4 — 4¼
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅔d.	Do. 7% Cum. Pref.	1	$1\frac{5}{16}$—$1\frac{7}{16}$
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	$4\frac{15}{16}$—$5\frac{1}{16}$
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	15/-	Anglo-American Tel. Co., Ltd., Ord.	100	60 — 62*
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	106 —107*
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15⅛—15⅜
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	230 —240
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½— 9
6,000	10	10/-	Do. 10% Preference	10	16½— 17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	8½— 9
£30,000	50	4½%	Do. 4½% Debs...	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11¼—11½*
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy) ..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14 — 14½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£1,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	139 —142*
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	91 — 93*
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	108 —110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	37 — 39
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	51 — 53
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	$\frac{13}{16}$— $\frac{15}{16}$
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	109 —110
£1,966 667	Stk	5%	Do. Deferred	100	100 —102
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5½ — 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	$1\frac{3}{16}$ — $1\frac{5}{16}$
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	8 — 8½
53,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	$\frac{5}{16}$— $\frac{7}{16}$
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	$\frac{11}{16}$— $\frac{13}{16}$
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼— 8¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8 — 8½
£80,000	100	5%	Do. 5% Deb.	100	103 —105
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾— 9¼
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk.. Red.	100	97 — 99
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100 —102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12 -- 13
40,000	20	8/-	Do. Nos. 60 001-100,000	10	5 — 5½
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200.000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	$1\frac{3}{16}$— $1\frac{5}{16}$
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¾— 5¼*
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	84 — 87
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	5¼ 5¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —136
£1,160,000	Stk	19%	Do. do. Deferred ..	100	229 —232
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	29½— 30½
89,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
89,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... .	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1— 1⅛
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	130 —135
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	$\frac{5}{16}$— $\frac{7}{16}$
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	$\frac{9}{16}$— $\frac{11}{16}$
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	$1\frac{1}{16}$— $1\frac{3}{16}$
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

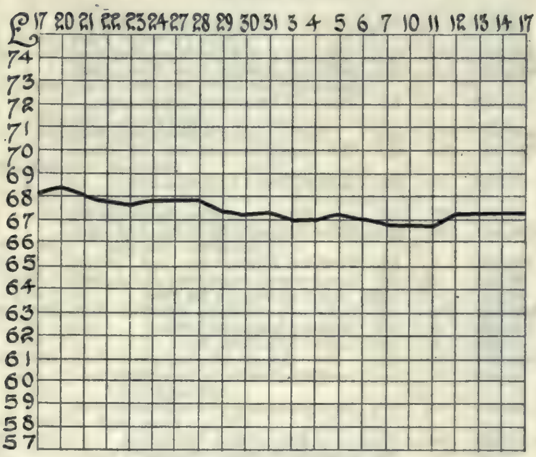
Present Amount Subscribed,	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22½—23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¾— 9
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	$2\frac{3}{16}$—$2\frac{5}{16}$
4,150	10	5%	Do. do.	10	10½— 10¾
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/6—44/-
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/-—25/-
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/- — 28/-
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

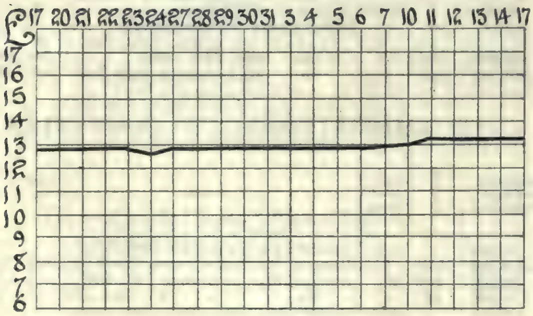
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM MARCH 17TH TO APRIL 17TH, 1905.

COPPER.



ENGLISH LEAD.



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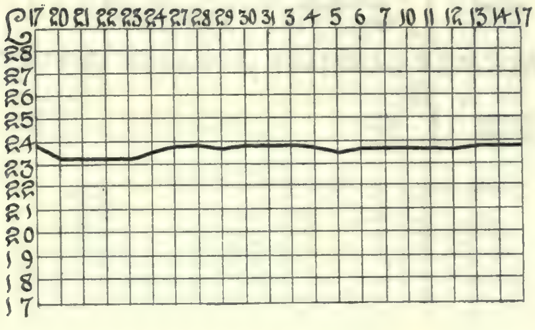
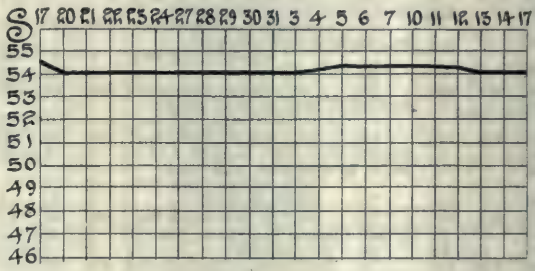


PIG IRON: SCOTCH,



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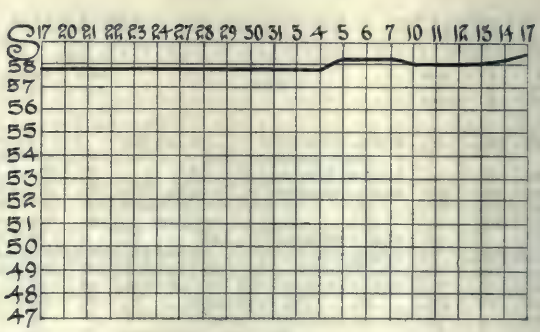
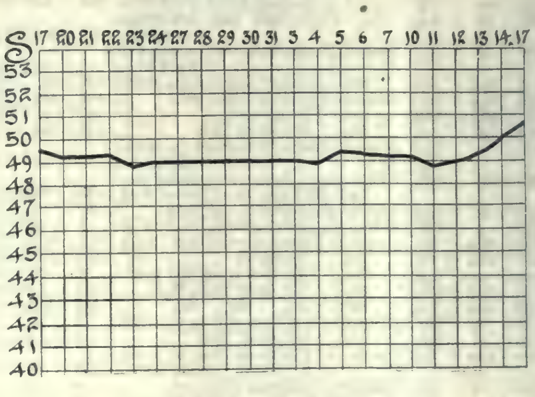


CLEVELAND.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Tuesday, April 18th, 1905.

THE more buoyant tone in Wall Street securities has had a somewhat favourable influence on the Copper market. The recovery in values was, however, somewhat short-lived, and the market has relapsed again into something approaching dulness, which is, perhaps, partly accounted for by the fact that we are on the eve of the holidays. There is, however, as Merton and Co.'s circular points out, a fair business doing in consumers' copper, although the buying has only been of a character to cover immediate requirements. The market went lower to-day.

The Tin market, which is the subject of a special article and chart in this issue, has witnessed some surprising developments. The necessity for covering the large bear account brought about a sharp spurt in the price of the metal, as high as £145 being paid for spot tin; but this demand having been satisfied, the heavy premium on cash metal quickly ran off.

Not for many years has the Iron and Steel market witnessed such activity as has been in evidence during the past week, the Glasgow Market in particular having been the centre of very active dealings. It is stated that quite 200,000 tons of warrants changed hands, and quotations fluctuated sharply. Cleveland, at the end of the week had risen to 50s. 3½d. cash, and in spite of realisations on the part of holders fresh buying took place with a further improvement in quotations to 50s. 7½d. Cleveland, 54s. 1½d. Scotch, and 58s. 6d. Hematite. Bull operators were stimulated by the March statistics cabled from America which showed that notwithstanding the enormous production, stocks had been encroached upon to the extent of 30,000 tons.

The quotation for Lead has again improved, a good demand from consumers being coincident with smaller arrivals. The closing price to-day was £12 16s. 9d. Foreign and £12 19s. 3d. English

Spelter is rather firmer at £23 15s. for ordinaries and £24 specials. Consumers are still buying somewhat sparingly, but the consumption is still large, and galvanisers are reported to have good orders in hand.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles..............................	5	7	6

Manufactured Iron:

	£	s.	d.
Bars—Dalzell..	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle..	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow ♕ Steel)	5	7	6	per ton.
Steel Ship Plates (Glasgow ♕ Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow ♕ Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best..................................	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix		—	
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0		—	
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♔	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♔ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♔ (BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♔ W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Shee's to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th nst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	12	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	12	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt.
} d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt.
} d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	10½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	0
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	7½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d	
Blooms	at	3	14	0	per ton.
Billets	at	3	16	0	,,
Sheet Bars	at	3	18	0	,,
Finished Steel:					
Bars	at	5	1	0	per ton.
Angles	at	5	2	0	,,
Tees	at	5	5	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	7	6	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	139	0	0	to	140	0	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	140	0	0	to	141	0	0	,,
Straits G.M.B., cash Warehouse, Net	139	10	0	to	140	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	135	0	0	to	135	5	0	,,
Australian, Mt. Bischoff, Warehouse, Net	139	10	0	to	139	15	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	67	5	0	to	67	7	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	67	10	0	to	67	12	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	10	0	to	71	0	0	,,
English, Best Select, Warehouse Net	71	10	0	to	72	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	81	0	0	to	82	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	1½	to	0	13	1½	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	4½	to	0	13	10½	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	15	0	to	24	0	0	per ton.
Blende of 50 % Net	6	9	6	to	6	12	6	,,
Calamine, Net	6	12	0	to	6	14	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	13	2	6	to	13	5	0	per ton.
Spanish, ex ship, Dis. 2½%	12	16	3	to	12	17	6	,,
Lead Ore of 70 %, Net	6	9	0			--		,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	35	10	0	to	36	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	9	10	0	to	10	10	0	,,
Crude, ex ship, Dis. 2½ %	14	0	0	to	16	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flas
Italian ,, ,, ,,	7	6	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with $\frac{1}{2}$ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit :

Kilburn Coal :	s.	d.
Best London Brights	9	9
Large Nuts ($1\frac{1}{2}$ to $3\frac{1}{4}$)	9	6
Small Nuts ($\frac{3}{4}$ to $1\frac{1}{2}$)	6	0
Rough Brights	6	0
Peas ($\frac{3}{8}$ to $\frac{3}{4}$)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal :

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	10	6
Large Nuts, 2 to 4 in. cube	8	6
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, $\frac{3}{8}$ to 1 in. cube	5	0
STEAM.—TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	6

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote :

	£	s.	d.	
Acids : Oxalic	0	0	$2\frac{1}{2}$	per lb.
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	$10\frac{5}{8}$	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	15	0	,,
Alumina : Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia : Carbonate	0	0	$3\frac{5}{8}$	per lb.
Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	12	6	,,
Arsenic : Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax : British Refined Crystal ,,	12	0	0	,,

Coal Tar Products :				
Benzole, 50/90 % ,,	0	0	6	per gal.
,, 90% ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb.
,, ,, ,, 39/40° C. ,,	0	0	$6\frac{1}{4}$	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, $62\frac{1}{2}$% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ,,	0	0	$1\frac{7}{16}$	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	9	0	per ton.
Copperas : Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper : Sulphate	21	12	6	,,
Cyanides : 98% minimum f.o.b. net	0	0	$7\frac{1}{2}$	per lb.
Lead : Acetate (Sugar) White. English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	15	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood) : Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash : Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull	18	10	0	per ton.
Caustic, 75/80 % ,, ,,	20	15	0	,,
Chlorate net	0	0	$3\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	5	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
,, ,, ,, Refined..... ,,	6	5	0	,,
,, Carbonated, 48 %........... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %.............. ,,	10	10	0	,,
,, ,, 70 %.............. ,,	9	12	6	,,
,, ,, 60 %.............. ,,	8	12	6	,,
,, Cream, 60 %..... .... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	15	0	,,
Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
Nitrate...ex quay Liverpool, ... ,,	11	5	0	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts).............	1	12	6	,,
,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers....................................	7	10	0	,,
Zinc: Sulphate	6	15	0	,,
Shellac: Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton,. f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports..........................	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	1½	to	0	13	1½	per unit.
Regulus, 45 to 55%	0	13	4½	to	0	13	10½	,,
Precipitate, 65 to 80% ...	0	13	7½	to	0	14	1½	,,
Tin Ores, 70 %...............	86	0	0	to	88	0	0	per ton.
Lead Ore, 70%					6	5	0	,,
Blende, 50%					6	9	6	,,
Calamine........................					6	12	0	,,
Antimony Ore, 50%......	7	10	0	to	8	10	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	6	5	per ton.
Do.	,,	Cartagena	6	8	,,
Special low phos,	,,	Porman	7	1	,,
Do. do.	,,	Cartagena............	7	4	,,
Extra quality do.	,,	,, ...	7	8	,,
Special Iron Ore	,,	,, ...	8	4	,,
Specular 58% do,	,,	,, ...	9	4	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine..............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	7	5	0		7	15	0
Nova Scotia Spruce.........	,,	7	0	0		7	10	0
Spruce Boards................	,,	5	15	0		6	5	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..........	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish.......................... ...	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber ...	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

6953. T. S. Fildes and E. S. Fildes, Manchester. April 3rd.—Improvements in geysers or apparatus for rapidly heating water.

6961. E. Bennis, Manchester. April 3rd.—Improvements in fronts of steam boiler and other furnaces.

6966. A. Hunnable, W. F. Prentis, and C. E. Prentis, Ilford. April 3rd.—Improvements in tool holders for turning and other lathes.

6971. U. Pickles, J. Thompson, and J. Walton, Halifax. April 3rd.—New or improved means for preventing or consuming smoke in steam boiler furnaces and the like.

6977. A. Jones, Wigan. April 3rd.—Rapid arresting reciprocating and alternate controlling lever device.

6986. G. U. Merrill, London. April 3rd.—Improvements in combined strainer and valve. (Date applied for August 2nd.)

7007. J. Halliwell, London. April 3rd.—Improvements in or relating to means for increasing the evaporative power of steam boilers and minimising smoke.

7008. L. Ottinger, London. April 3rd.—Improvements in safety circuit closers.

7025. H. Lentz, London. April 3rd.—Braking and reversing gear for fluid pressure turbines.

7029. J. S. Fairfax. London. April 3rd.—Improvements in or relating to change speed driving gear.

7049. E. K. L. Plotz, London. April 3rd.—Improvements in drills.

7069. G. Barker, Birmingham. April 4th.—Combined condenser and feed water heater. (*The Ferguson Co., U.S.A.*)

7075. J. A. Main, London. April 4th—Electrically controlled device for operating valves of internal combustion engines.

7078. Albion Motor-Car Company, Ltd., and T. B. Murray, Glasgow. April 4th—Improvements in mechanical feed lubricators.

7100. T. Suzuki, London. April 4th.—Improvements in vertical boilers.

7102. H. A. Humphrey, London. April 4th.—Improvements in pressure reducing valves.

7114. R. E. Saunders, London. April 4th.—Improvements in and relating to apparatus for separating gold and other metals from their ores.

7115. D. M. Small, London. April 4th.—Improvements in combined engine and generator.

7151. H. S. Walker and D. Horsborough, Prestwich. April 5th.—Improvements in pumping engines, air compressors, or exhausters and the like.

7152. S. Walker, Hanley. April 5th.—Improvements in reversible gears.

7162. J. Williams, Glasgow. April 5th.—Improvements in packing for stuffing boxes and the like.

7167. A. Swanson, Glasgow. April 5th.—An improved construction of windmill or motor.

7172. S. J. and E. Fellows, Ltd., and A. Nightingale, Wolverhampton. April 5th.—Improved means for use in the lubrication of internal combustion engine cylinders.

7180. P. S. Swan, Glasgow. April 5th.—Improvements in connection with the utilisation of steam in condensing steam motors and for other purposes.

7240. W. L. Emmet, London. April 6th.—Improvements in governing mechanism for elastic fluid turbines. (Date applied for April 5th, 1904.)

7242. H. G. Jenkins, London. April 6th.—Improvements in power transmission gear.

7263. A. J. Canema, Langbank. April 6th.—Reversing and controlling rotation in internal combustion engines.

7267. M. Moore, London. April 6th.—An improved composition for making refractory bricks, furnace linings, tuyeres, retorts, crucibles, and the like.

7268. M. Moore, London. April 6th.—An improved composition for making refractory bricks, furnace linings, tuyeres, retorts, crucibles, and the like.

7274. W. A. B. Culpeper, London. April 6th.—New method of heating steam boilers by the internal explosion of gases.

7280. M. Whitaker and Whitaker Bros., Ltd., London. April 6th.—Improvements in or relating to excavating apparatus.

7281. C. J. Mather and A. R. Rixon, London. April 6th.—Improvements in or connected with joint-making packing for gas, oil or steam engines, pipes conduits and the like.

7282. G. Pollard, London. April 6th.—Improvements in or relating to stuffing boxes.

7283. T. F. J. Truss, London. April 6th.—Improvements in or relating to screw propellers.

7289. H. Lentz, London. April 6th.—Improvements in and relating to fluid pressure turbines.

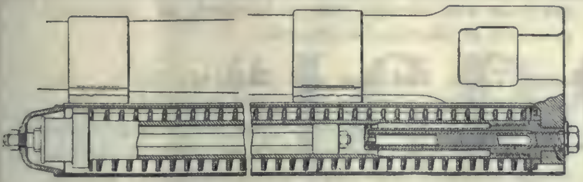
7306. J. Max, London. April 6th.—Improvements in and relating to portable hoists.

RECENT SPECIFICATIONS.

BRAKE MECHANISM FOR ORDNANCE.

Fried Krupp Akt.-Ges., of Essen, Germany. March 31st, 1904.—The object of this invention is to improve the apparatus for securing the brake cylinder to the barrel of the gun, and for mounting the running out spring in ordnance with barrel recoil. The device is comprised of apparatus for attaching the brake cylinder to the barrel of the gun and for mounting the running-out spring, in which the screwed spindle is provided with a closed sleeve which surrounds it and projects into the liquid chamber of the brake cylinder, supporting the free end of the sleeve in the brake cylinder by lugs formed or fixed to the said sleeve.

Fig. 1.



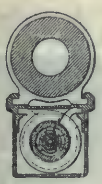


Fig. 2.

APPARATUS FOR LIFTING AND LOADING COAL, ETC.

F. W. Tannett-Walker, of Leeds. May 13th, 1004.—This invention has for its object economy in working, and improvement in the strains on the table and framework of coal tips and other hoists, and also economy in water consumed when these tips are worked by hydraulic rams. It is a common plan to put two or more rams under a hoist and either by having one of them in constant communication with the main or by different combinations of valves, make them to use pressure water reasonably in proportion with the loads lifted; but the great objection to this system is that it makes the greatest drain on the main when both the rams go up, and very frequently when the table is descending and should be forcing water back into the mains, the accumulator happens to be at the top, and therefore the water is only forced back through the escape valve into the tank, which, of course, causes no economy. According to this invention, in addition to the usual hydraulic ram or rams for raising the hoists, a ram or rams are provided for lifting a counter-balance weight or weights which tend to raise the hoist so that as the rams of the main cylinder rise and use water, the rams of the counter-balance weight cylinder lower and force out water, supplying it through the actual pipe of the machine direct into the main cylinder and not into a distant accumulator.

Fig. 1

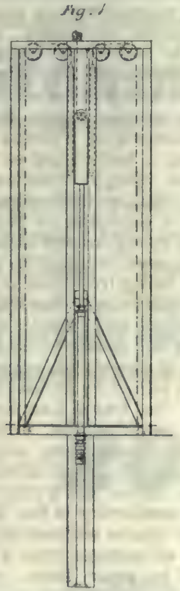
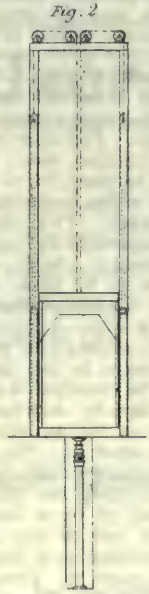


Fig. 2



CORLISS AND THE LIKE VALVE GEAR.

Alexander Smart, of Erith. January 23rd, 1905.—This invention relates to improvements in Corliss and the like gear with the object of reducing the friction on the various parts to a minimum, and consequently the wear and tear upon the valves and operating mechanism of the gear. With this object in view the invention consists in so arranging the valve operating mechanism, that as far as possible the forces are applied direct from the source of origin to the part or parts in which motion is desired, whereby the resultants of said and their reactions are reduced, and the wear on the working parts minimised. In carrying the invention into effect the steam valve rockers are preferably pivoted on or adjacent to the valve bonnets, and are connected by the steam valve catch bar, which engages the steam hooks carried by the steam valve levers to which are also attached on the same side of the valve spindles, and as near to said levers as possible, the dash pot levers. Further the eccentric rod by means of which the gear is operated from the engine is connected at a point as near as possible to the point on the steam valve levers at which the catch plate bar is pivoted. The arrangement of the parts is made in such a manner that the valve and dash pot levers are fulcrummed on the same centre and on the same side of the valve spindles to form levers of the second order. In valve gears of the character described, the arrangement of the parts so that the valve and dash pot levers form a double armed lever with both arms disposed on the same side of the valve spindle and pivoted respectively to the dash pot rod and to the steam hook on or about the same centre, while the catch bar and the operating eccentric rod are pivoted also at or about the same centre on the valve rockers, whereby the applied forces and their reactions, act upon the same side of the valve spindle, and as nearly as possible in the same plane, thus reducing the resultants to a minimum, and correspondingly reducing the wear and tear of the parts substantially as described.

Fig 1

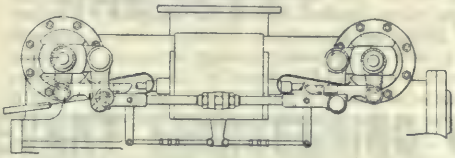


Fig. 3

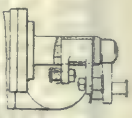
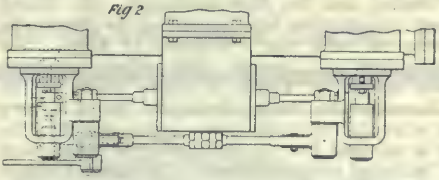


Fig 2



NEW PUBLICATIONS.

"OUR SOUDAN: ITS PYRAMIDS AND PROGRESS."

By John Ward. John Murray, 21s. net.

Mr. John Ward's new work is chiefly of antiquarian interest, but it also is of considerable value to the engineer, as it includes for the first time in one volume all the most recent information on the proposals which have been made for the irrigation of the Soudan. It is dedicated to Lord Kitchener whose Soudanese campaign and metamorphosis of Omdurman are described at length. As regards the Sudd problem Mr. Ward thinks it is possible that Sir William Garstin's scheme for cutting a great Nile Canal northward from Bor, may entirely solve this. Among many valuable portraits is one of Lieut-Colonel Malcolm Peake, R.A., who is described as the conqueror of the Sudd. An account of his extensive operations, together with details of Sir William Garstin's scheme, appeared in PAGE'S MAGAZINE of September, 1904. Mr. Ward commences his itinerary at Wadi Halfa and takes us across the desert to Khartoum by the military railway of which he says, "This line was Sir Percy Girouard's greatest engineering feat; it was laid at the rate of upwards of a mile a day; one day 5,200 yards were laid. It was completed on December 31st, 1897. It was a bold scheme and splendidly carried out." The author has devoted several chapters to the route by the river banks making an imaginary journey from Abu Halfa to Khartoum, noting points of interest by the way, and occasionally making detours. He then follows the Nile beyond Khartoum to its remotest region at the equatorial lakes. Having followed the White Nile to its source, he proceeds to explore the eastern provinces—the Blue Nile and its tributaries. The volume concludes with an account of the western provinces, Kordofan, Darfur, and the Bahr-el-Ghazal. Mr. Ward has bestowed considerable attention upon the Pyramids. These, compared with the Pyramids of Egypt, are modern structures. It seems that when pyramid building was extinct in Egypt it began anew in the Soudan. Nevertheless these Pyramids have a very respectable antiquity of from 3,000 years downwards, and supply a missing link, as the history of a thousand years may be found recorded here. The Soudan would appear to offer a most promising field of investigation for the antiquarian, and Mr. Ward is strongly of opinion that researches should be made under a properly constituted antiquarian department in connection with the museum at Khartoum. The author has succeeded in gathering together a unique collection of photographs, and in one of his early pages he says—"Skip the letterpress the pictures will teach you all you need to know." We scarcely think that any reader who takes up Mr. Ward's instructive volume will be disposed to carry out this advice; it is probable that the illustrations will lead him to peruse the whole of the text and if he does this he can scarcely fail to acquire an excellent notion of the Soudan to-day.

"MODERN IRON FOUNDRY PRACTICE."

Part II. Machine mouldings and moulding machines, physical tests of cast-iron, methods of cleaning, casting and foundry accounting. By Geo. R. Bale. The Technical Publishing Company, Ltd., 3s. 6d. net.

We have already called attention to the first part of this work; the second part is mainly devoted to machine moulding and moulding machines. The author has made a careful selection from among the numerous makes of machines, with view to including typical specimens of each class; the accompanying illustrations from a technical point of view are excellent.

NEW CATALOGUES.

Messrs. Davies, Kent and Stewart, Ltd., 17, Berners Street, Oxford Street, W., specialists in wall connections and flexible wires, forward an illustrated price list of electrical accessories.

Messrs. T. D. Robinson and Co., Ltd., Derby. The latest price list of rivets, bolts, etc., received from this firm, bears on the cover an original advertising design of considerable merit, illustrating the practical application of iron, steel and copper rivets, and giving striking prominence to the initial letter of the firm, which by the way, was established in 1817. The list, which should be obtained and filed for reference, reminds us that the firm's speciality consists of rivets and bolts for general constructional and marine engineering, boilers, tanks, agricultural implements, structural work, etc. Attention is called to their small rivets, viz., tinsmiths', reaper, hoop, keg and shovel rivets, baling studs, cycle brazing pegs, collar pins, etc. The firm also quote for boiler stays, railway spike, retort bolts, fish bolts, black bolts and nuts, in all sizes and shapes (Whitworth standard dimensions and threads), and for copper rivets for fireboxes, brewers' appliances, leather hose and belting rivets, and washers. They supply cut and wrought nails of all kinds in iron, steel, copper and zinc; also iron and steel cart clouts. We note that they are contractors to the Admiralty, the War Office, the India Office, and the Crown Agents for the Colonies.

The C. W. Hunt Company, of New York, have issued a freely illustrated pamphlet on the subject of the Hunt Noiseless Conveyor and other machinery for handling coal and ashes in power stations. The earlier portion gives a general description of various mechanical methods, and the remaining pages illustrate particular installations, with brief notes suggested by the peculiarities of the plants. In some cases mechanical methods had been adopted to existing buildings, and in others they had been limited by the appropriation available, thus requiring a solution other than the ideal one. The conveyor consists of a series of cars linked together, each having a body hung on pivots, gravity keeping them in an upright position, irrespective of the horizontal, vertical, or inclined position of the track. The change of direction of the chain is accomplished by running round curves instead of over sprocket wheels, the power required to run the conveyor in its usual work being from five to twelve h.p. It is claimed that the driving of the conveyor by pawls gives a motion evener and steadier than by sprocket wheels and permits the power to be applied at any point in the chain; it also obviates wear and tear. The conveyor is driven either by a two-cylinder engine directly attached to the frame carrying the gearing or by an electric motor, either belted or directly attached. We think a subsequent edition of this catalogue might be improved in two directions: (1) by printing the type in a colour less trying to the eyes, and (2) by a simpler numbering of the illustrations. A row of five or six figures without any kind of punctuation may have its advantages from a classification point of view, but to refer from type to illustration by this method seems unnecessarily cumbersome, *e.g.*, fig 42 is surely preferable to No. 04144. In other respects the pamphlet is admirably arranged.

PAGE'S WEEKLY Miscellaneous

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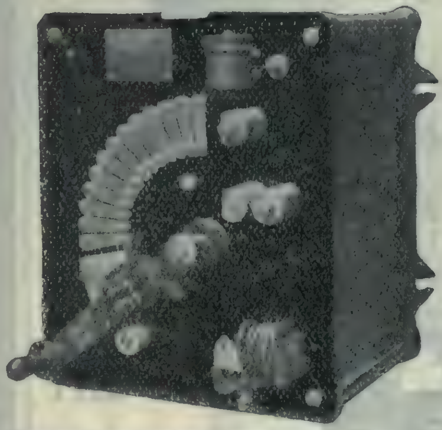

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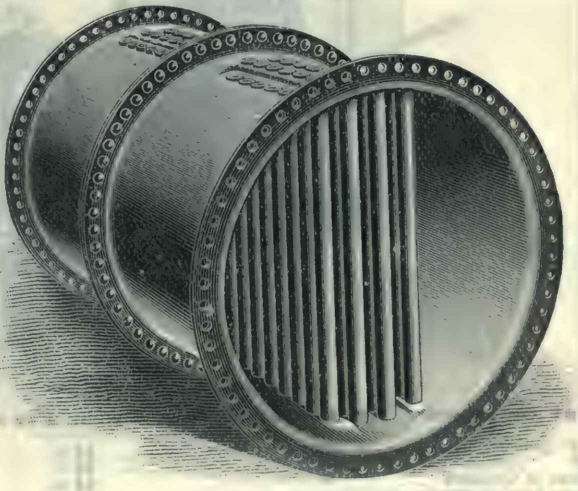

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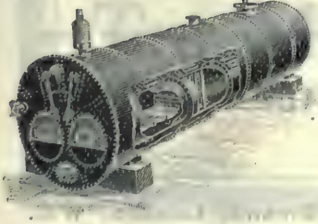

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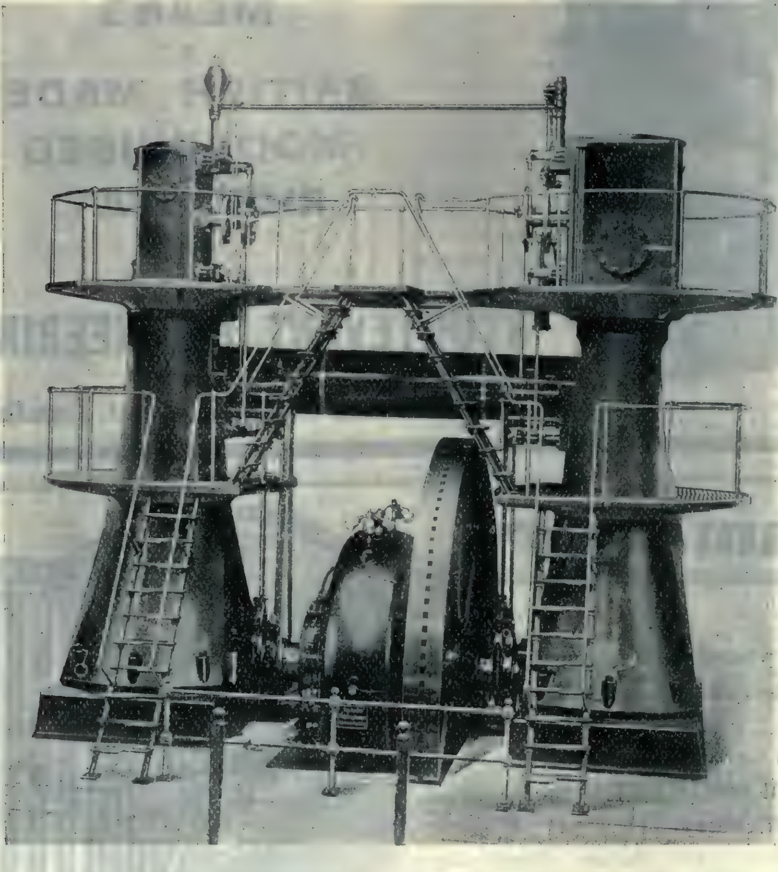

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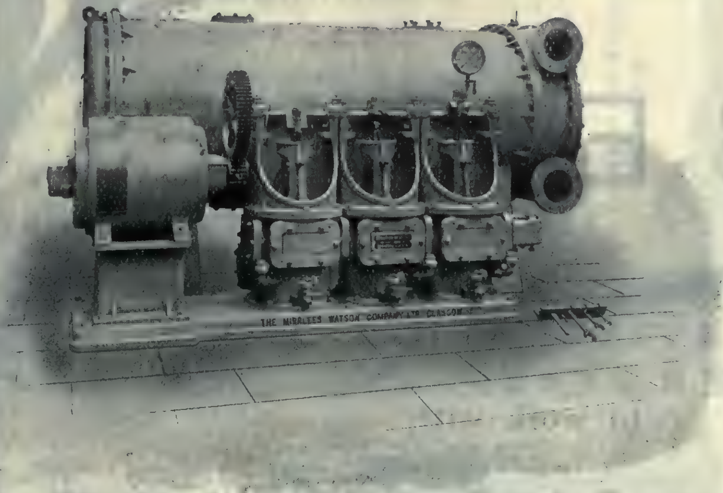

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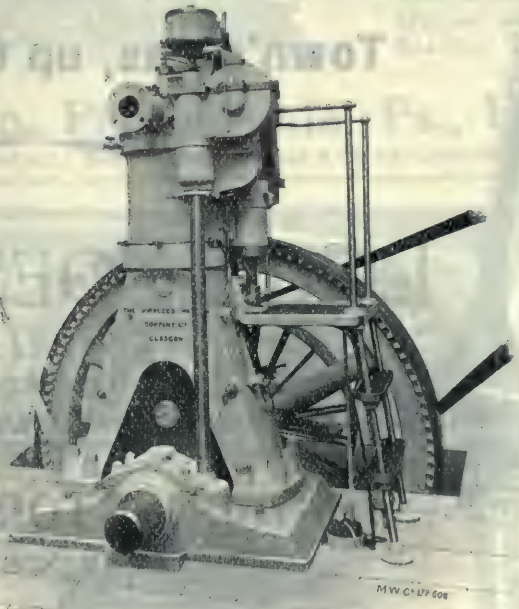

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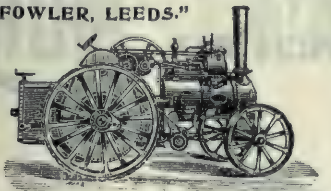

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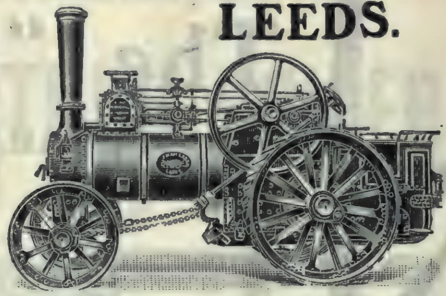

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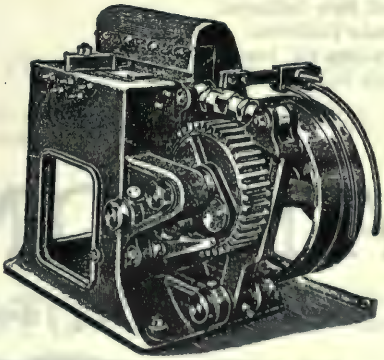

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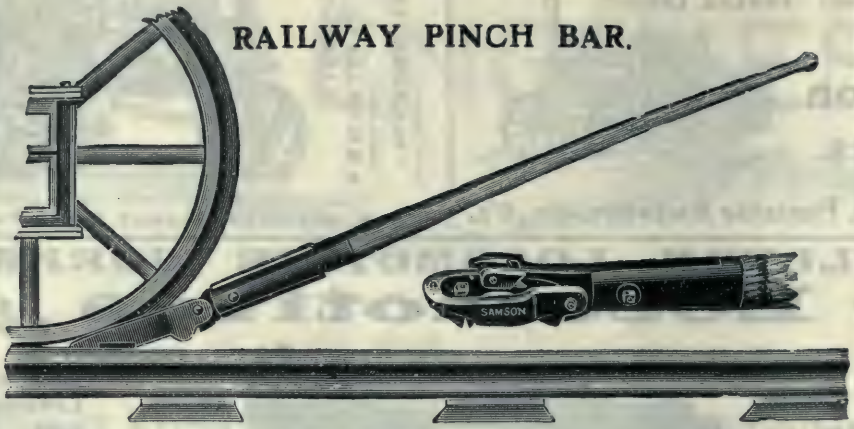

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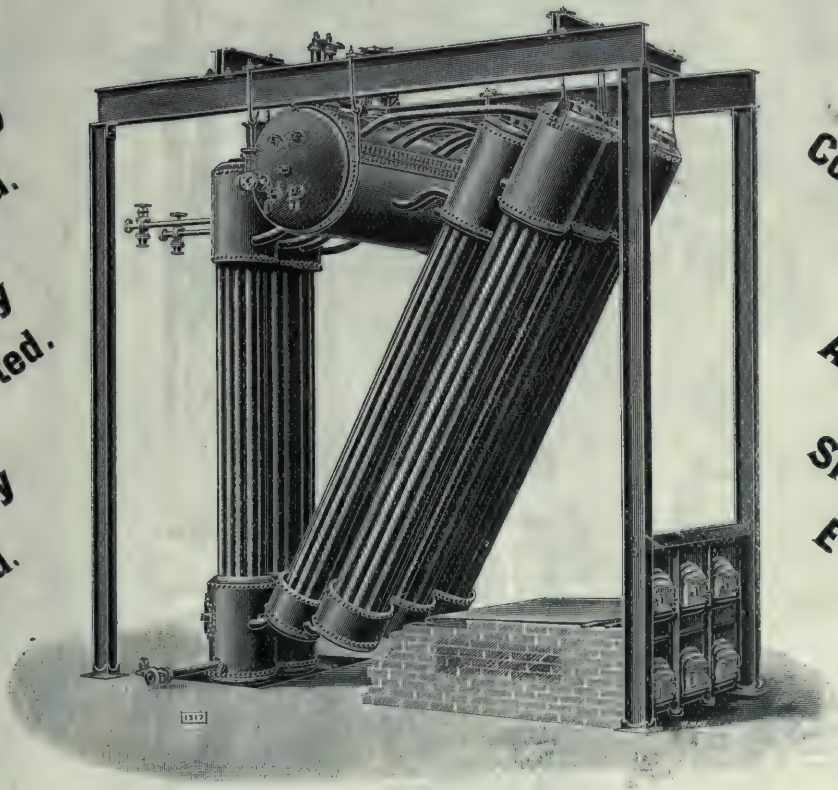

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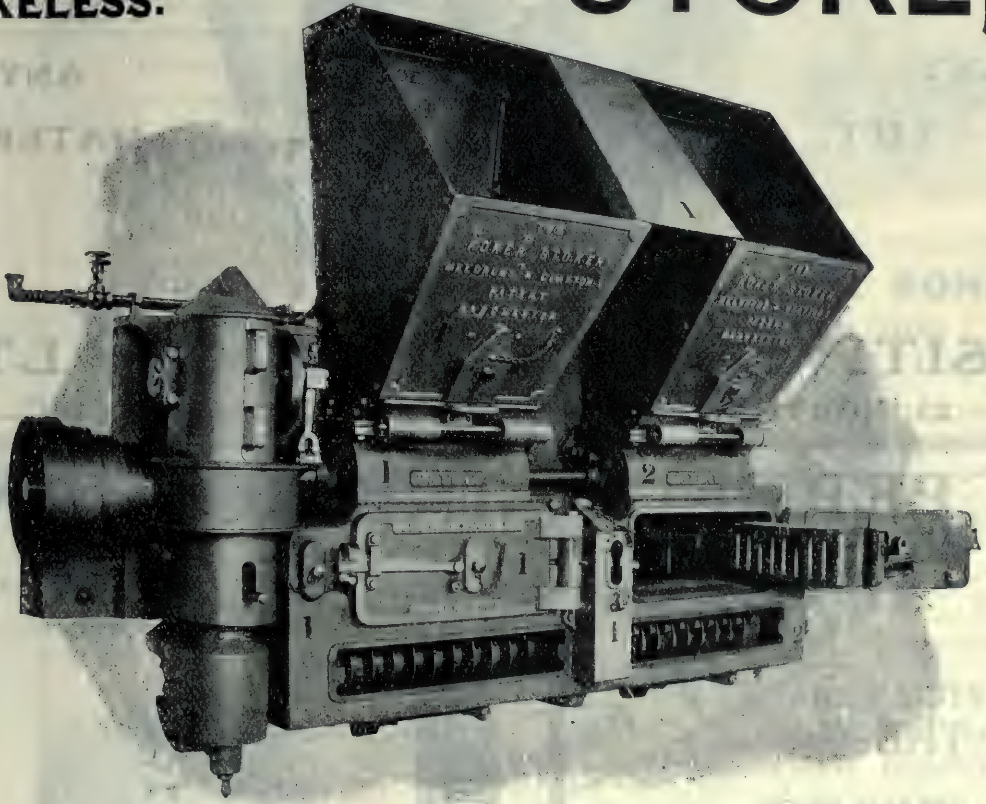

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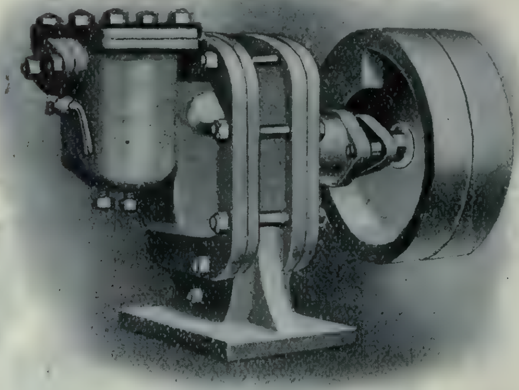

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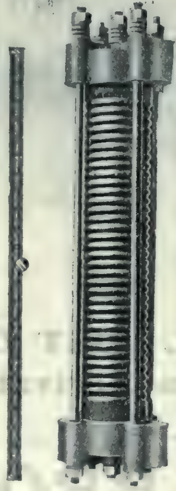

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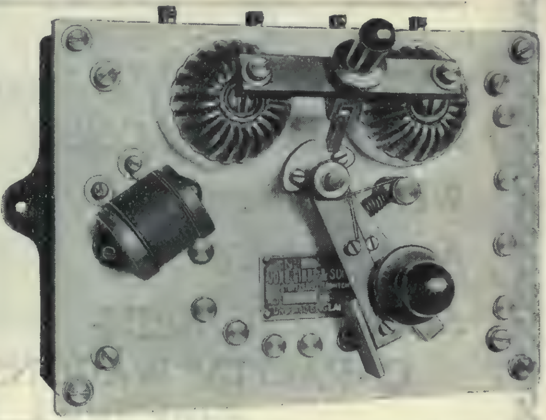

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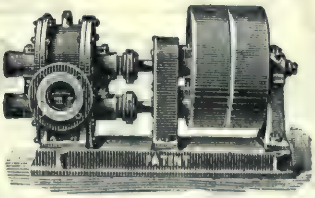

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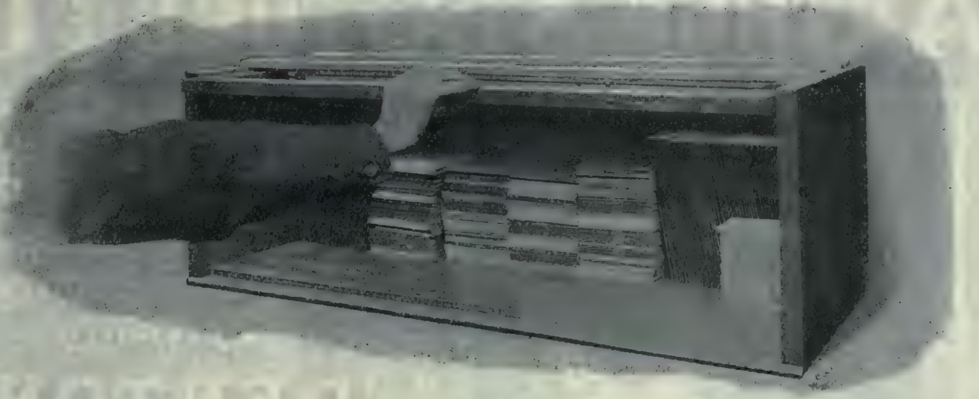

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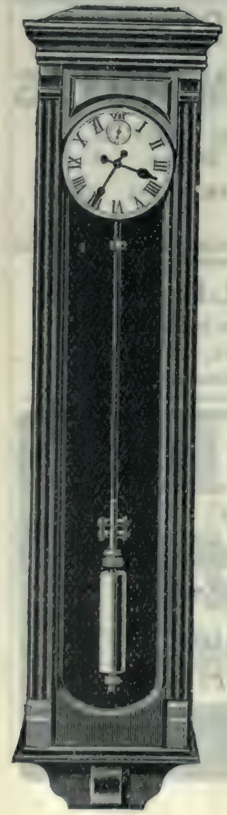

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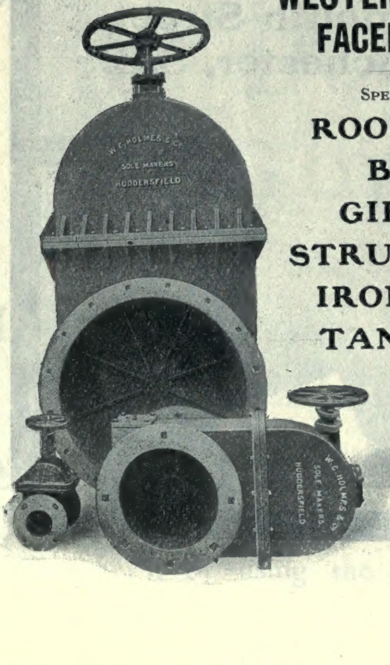

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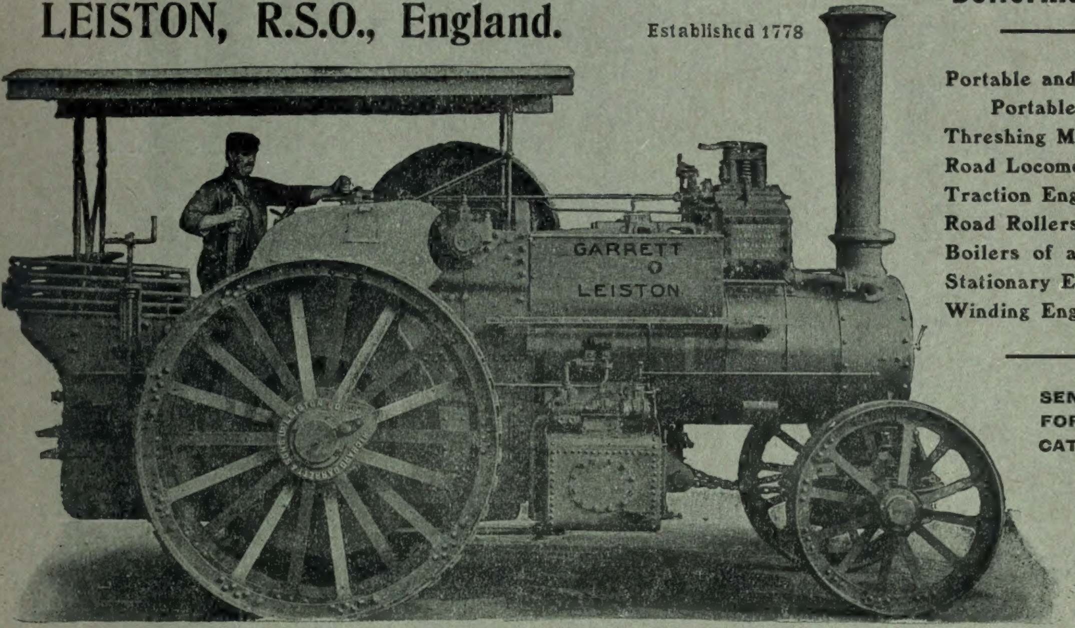

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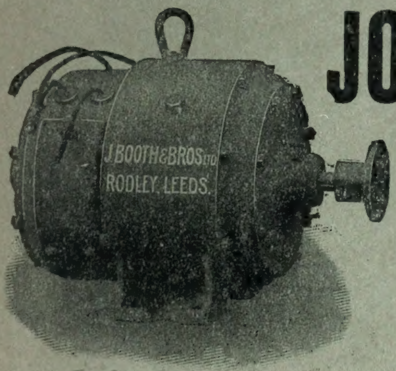

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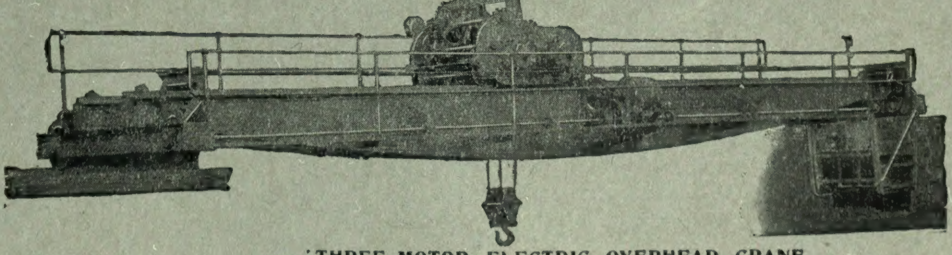

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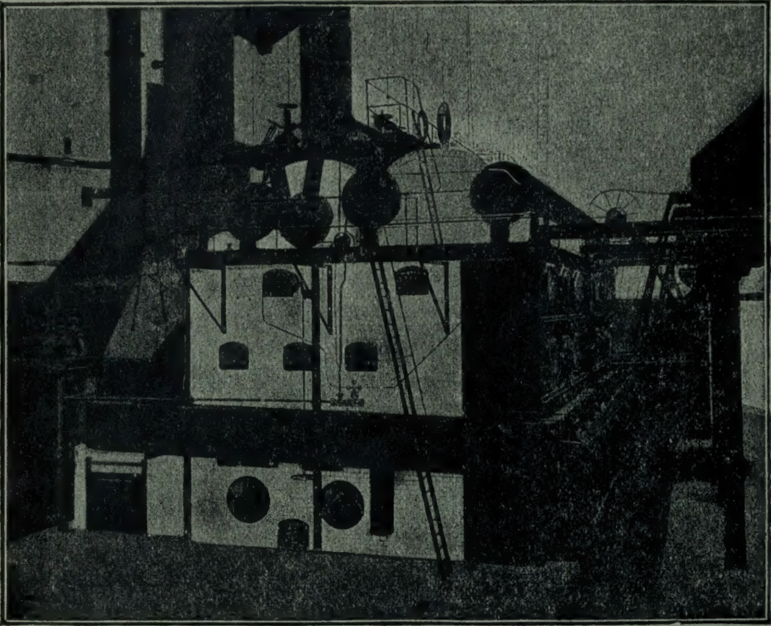

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